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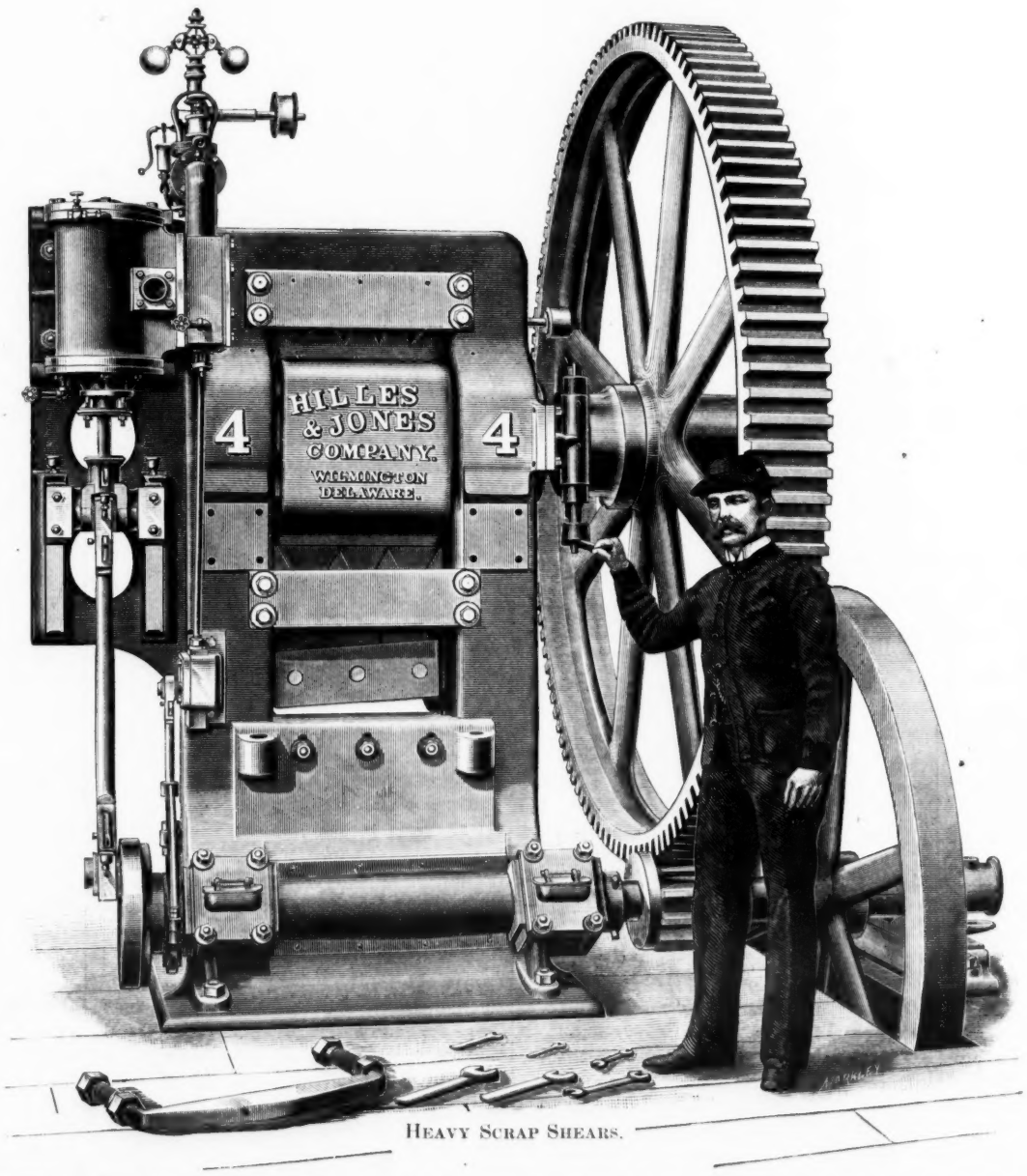
Heavy Scrap Shears.

Our illustration represents a heavy shearing machine, designed to cut steel 1½″ thick, 15″ wide, cold, and without bending the piece cut off, the latter object being attained by giving the upper shear blade much less inclination from end to end than usual, the amount in this case being only 1½″ in 22″. The knives are 8″ wide, 22″ long and 2″ thick.

The machine is driven by the engine shown at the left, which is substantially built and attached to the frame of the machine, and is supplied with governor and all necessary features for prompt and convenient handling. The crank-shaft is supported at the base of the machine, and the caps of the bearings being at an angle, the shaft may be removed without the necessity for disturbing the spur-wheel or any key. The spur-wheel is 10 feet in diameter, 3″ pitch, 10″ face, and weighs a little less than 6,000 pounds.

The main frame of the machine is of rectangular shape, the strain being taken by the straight vertical sides. The clutch is operated by a hand lever, and engages with a corresponding clutch on the spur-wheel, both of these being faced with steel. The total weight of the machine is about 36,000 pounds, and it is intended for heavy scrap work.

The builders are the Hilles & Jones Co., Wilmington, Del.



HEAVY SCRAP SHEARS.

The railway companies of Great Britain are demanding increased rates for transportation of freight, and among the other reasons given by them is the increased wages paid to employes compared with other years, and the much higher wages paid there than on the Continent.

Engineering, without, however, claiming to present a very complete exposition of the subject, nevertheless shows pretty conclusively that greater profits are made per employe upon the labor of the comparatively highly paid English railway employe, much greater gross earnings per employe being shown in the case of the latter.

It has been shown repeatedly and conclusively that a high daily rate of wages does not necessarily mean high cost of production, and that, in fact, it means just the opposite in nearly every case, especially where the labor employed is skilled labor, and this is only another instance of it.

William Stroudley.

William Stroudley, one of the great mechanical railroad engineers of England, is dead. The immediate cause of his death appears to have been a cold, improperly attended to. He died at the comparatively early age of fifty-seven, when his ripe judgment should have left before him at least ten of the best years of his life. The names and achievements of eminent English engineers are about as well known in this country as in England, hence it is that the death of such a man as Stroudley is looked upon almost as much in the nature of a calamity here as there. Such men live and work for the world, and not for any section. They cannot, if they would, circumscribe the influence of what they do.

William Stroudley was what in this country would be termed a self-made man. Born—if such a thing is possible—with a mechanical turn of mind, he forced his way, with but little of what is popularly called education, into positions in which he could cultivate the talents he possessed.

At the time of his death, and we believe for nearly or quite twenty years previous, he had been locomotive superintendent of the London, Brighton & South Coast Line. When he took this position mechanical matters on the line were in a rather deplorable condition. He built new shops, and soon established order and progress, of which there was little before.

He was an early advocate of compounding in the instance of marine engines, and his efforts in putting compound engines in the company's boats were highly successful, and went far towards establishing the principle. Stroudley studied engineering from the practical side. He worked his way into the profession with nothing to unlearn. What he learned he learned with certainty, and it did him excellent service. He made a name that will long be remembered.

Force—Momentum.

BY PROF. DE VOLSON WOOD.

Any writer may define terms as he uses them, but it is unfortunate for the reader if he uses them in a sense different from that which custom has established. The term *force* has been misused by being applied to quantities in which force was only one of the elements. Thus we have seen the terms "force of a moment," "force of momentum," "force of work." *Force* is essentially *stress*. It is always equivalent to a *push* or *pull*. In this respect there is no difference between "static force" and "dynamic force," and if these terms are used they do not signify any difference in the character of the force, but a difference in the result produced, the former being considered as acting upon a body without producing motion, the latter producing a change of motion of the body acted upon.

We have seen "dynamic force" defined as the product of the weight into the velocity of the body, or $F = w\,v$. But this is not a force in any sense. A body having a velocity v would move forever with that velocity if not opposed by a force, and the product be $w\,v$ continually. The expression $w\,v$ is very nearly the quantity usually called "momentum." Change the term *weight* to *mass*, and call the latter m, and the expression becomes $m\,v$, which is called "momentum."

A force may be measured in two ways: First, by the direct pull which it exerts, the value of which may be indicated by a spring balance, and second, by the change of motion produced in a moving body. No one has difficulty with the former. To illustrate the latter, suppose a boy pulls a sled weighing 12 pounds on level and perfectly smooth ice, with a constant pull, beginning with no velocity and producing a velocity of 8 feet during one second; required the pounds of pull exerted on the sled. The ice being perfectly smooth, there will be no friction. We will have

$$F = \frac{12 \text{ pounds} \times 8 \text{ feet vel.}}{32\frac{1}{6}}$$

$= 3$ pounds of pull, nearly.

The $32\frac{1}{6}$ in the denominator is velocity which a body acquires in falling freely under the action of gravity during one second. Some readers may understand the following analysis better; thus: If gravity causes a weight of 12 pounds to have a velocity of $32\frac{1}{6}$ feet when falling vertically, how much force will be required to produce a velocity of 8 feet? Putting it in the form of a proportion, we have

$$12 : F :: 32\tfrac{1}{6} : 8,$$

which gives 3 pounds nearly, as given above. We desire to have it especially noticed, that the 3 pounds of pull is the measure of the force, whether the sled moves or not. If the sled were held so that it could not move, the force would be measured by a spring balance only. If the sled moved freely, the pull of 3 pounds would produce only half the velocity if its weight were doubled, or twice the velocity if its weight were one-half as great.

It is apparent that the product of the weight by the velocity, $12 \times 8 = 96$, is not a measure of the force; neither is it a dynamic force in any proper sense.

The force producing a change of velocity of a body is measured by the rate of change of the momentum. In other words, it is the product of the mass of the body into the increase of the velocity in one second—the increase being uniform. If the velocity were 100 feet per second, and the velocity were increased 2 feet per second, the force producing the change would be $m \times 2$, and if the velocity were 20, 50, 300, or any other velocity, and it be increased 2 feet per second, the force in all cases acting during that second would be $m \times 2$, in which m is

the weight of the body divided by $32\frac{1}{6}$. The force thus found would be a certain number of pounds, or their equivalent in other units.

Pattern Making.

BY P. S. DINGEY.

SHEAVES—SECOND PAPER.

There is not much scheming required to make a pattern for a sheave such as appeared in my last paper, and yet to show the way the pattern should be made may not be entirely out of place here, as I want to bring in a few points that have not hitherto been named.

I have said that into the groove of this sheave are bolted segments that take the rope. The advantage of this arrangement is evident, as it allows the segments to be renewed when worn out. I have shown in Fig. 7 a part of the rim and a cross-section of the sheave; this shows the way the segments are secured to the sheave. I have said the groove into which the segments are bolted is to be turned; not so with the groove of the segment—this is left rough.

Chipping strips are cast on the sides, as seen at *a b c d*, in Fig. 8, and it is intended that the segment shall not bear in the bottom of the groove, but only on the chipping strips by the sides, and at *e e*; see cross-section, Fig. 7.

Fig. 8 shows the pattern of the segment. Let us suppose it is to be moulded edgewise, the groove being in the cope; it is desired to cast the bolt-holes, and care must be taken in spacing them off, because they are wanted to match those in the sheave, which are also cast in. I have marked the core-prints for these holes in Fig. 8; the bottom print is made something like the cope print—oblong, as shown at *f*; this is done in order that the core may lie in the mould more securely while the cope is being put on. If a round print was used just the size the holes were wanted, the cores would be top-heavy, and difficult to locate in the mould; hence the necessity of making the bottom print as I have shown it. The core-box for this bolt-hole should be made as shown in Fig. 9.

Now let us turn our attention to the pattern for the sheave. It is understood that these sheaves are bolted together in halves, so that, in making a pattern, one-half will only be required. Proceed by building up and turning a whole ring, of which Fig. 10 shall be the section; *A* is the print for carrying the groove cores. After turning the ring, cut a stick the exact length of the inside diameter—this will be a gauge that can be used to see whether the ring has sprung after being cut in two, and, if it has, to bring it back to the gauge when fastening in the arms. After sawing the ring in two, glue and screw it together strongly, as seen in Fig. 11; but before doing so it should be remembered that stock for planing must be allowed at the joints where the ring is bolted together, so that the pattern should be, say, $\frac{1}{4}''$ over the half circle. In order that this may be, the ring should not be cut exactly in halves, but $\frac{1}{4}''$ one side of the center; this would make one part about $\frac{1}{8}''$ short, not reckoning anything for saw cut—with the saw cut it would probably be $\frac{3}{4}''$ short. Now if two ends of these two sections are brought together it will only be necessary to build on one end of one of the sections. Having done this, the ring is ready to have the arms fitted in, which should be done by letting them in the rim, as represented by dotted lines at *A B*, Fig. 7.

Care must be taken not to fit the arms in so tight as to spring the ring out of round; this can be very easily done. After locating the arms, bore two $\frac{3}{4}''$ holes from the outside of ring into each arm, and glue in some hard wood dowel pins; this will make a strong job. The small bosses, of which one is shown at *C*, Fig. 7, are turned and sawed out with a narrow band-saw to fit over the rim. This is done by inserting each boss in a block with a hole through it the size of boss; two views of this block are shown in Figs. 13 and 14. The boss is fixed in the hole *D*, and sawed to the shape of the inner part of rim. Of course the block is fitted over the rim first, and so acts as a guide to saw them out.

The core-box for the groove need not be made with loose piece in the bottom, as in the case of forming these sheaves with cores, because the cope closes down on the top of print, and not on the dotted line; see Fig. 11. The same plan of bolting in segments, and for making same, is being adopted for two and three-groove sheaves. There is also another type of sheave made with segments bolted in, a description of which, and the making, will be the subject of another paper.

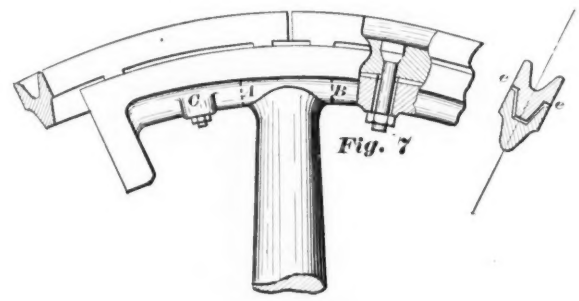


Fig. 7

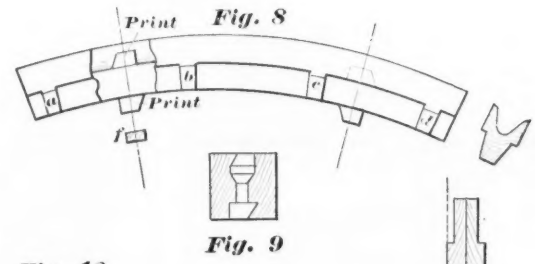


Fig. 8

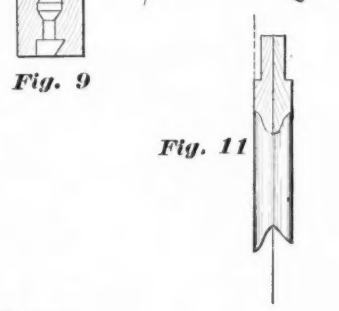


Fig. 9

Fig. 10

Fig. 12

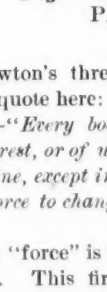


Fig. 13

Fig. 11

PATTERN MAKING.

Force, Motion and Work.

BY PEDRO.

NINTH PAPER—RELATION OF STATIC AND DYNAMIC FORCE.

In the last paper we have seen what static and dynamic forces are in a general way—that the former is that which produces motion, and that the latter is a part of the motion. In other words, dynamic force is an effect, the cause of which is static force.

Let us now examine the relation that static force bears to the dynamic force developed by it. To do this we will be greatly assisted by carefully studying Newton's three laws of motion, which we will quote here:

FIRST LAW OF MOTION.—"*Every body continues in its state of rest, or of uniform motion in a straight line, except in so far as it is compelled by force to change that state.*"

In these laws the term "force" is used in the sense of static force. This first law simply means that matter is inert; that is, that matter of itself has no power of locomotion. When it is at rest it cannot move itself. When it has been set in motion by some agent, it will continue to move forever if not stopped by some influence external to itself, because it cannot stop itself. When it has been set in motion by a force it must continue to move with the same velocity that it had at the instant the force ceased to act, and it must also continue to move in the same direction that it was then moving, because it cannot do otherwise. This inert property of matter is called *inertia*.

SECOND LAW OF MOTION.—"*Change of motion is proportional to force, and takes place in the straight line in which the force acts.*"

That is, when a body is acted upon by a force, the motion imparted to it, if free to move, whether it was already in motion or at rest, is directly proportional to that force, and the motion imparted to it is in the direction in which the force acts, because, according to the first law, the body cannot do otherwise than move in obedience to the acting agent.

THIRD LAW OF MOTION.—"*To every action there is always an equal and contrary reaction; or the mutual actions of any two bodies are always equal and in opposite directions.*"

This means that, if we hold a stone upon our hand weighing two pounds, for example, the stone exerts a downward pressure upon our hand of two pounds, and, at the same time, the hand exerts an upward pressure (in the opposite direction) of two pounds upon (or under) the stone, to support it.

If the opposite poles of two magnets are brought near to each other, they will be drawn together, and the pressure or stress upon the first is exactly the same as that upon the second, but in the opposite direction.

Generally, when two bodies are pressed together, a stress is produced between them at their surfaces of contact, and the direction of the stress is at right angles to those surfaces at their point (or points) of contact, and from them towards each body respectively.

Now, what relation does static force bear to dynamic force?

To determine this, we must examine a body in motion. The most convenient motion for this purpose is that caused by gravity. It has been ascertained by experiment that in the latitude of New York City the acceleration due to gravity, is 115776. feet a minute. In the eighth paper, Equation 28, we have seen that the dynamic force of a moving body is its weight multiplied by its velocity, and, since the acceleration of a body is its velocity at the end of one minute, when starting from rest, we would have for the dynamic force of a ten-pound ball, falling freely through space,

$$F = 115776. \times 10 = 1157760. \text{ foot-pounds.}$$

Now gravity produces a uniformly accelerated motion; the velocity of a body, therefore, varies, and hence it would seem that the dynamic force is variable according to the rule just applied, because, in two minutes the velocity of a falling body is 231552 feet a minute (Rule 13, fourth paper,) and therefore the dynamic force at the end of two minutes would be $231552. \times 10 = 2315520.$ foot-pounds. This is truly the case. Variable dynamic force is measured in the same manner as variable motion. In the fourth paper we have seen that the velocity of a body having a variable motion is measured at any given time by its *rate of speed* at that time; that is, its velocity expresses the distance the body would move in one minute following the given time, if it would continue to move with a uniform speed from that time. In the same manner a variable dynamic force is measured by the *weight* of the body, and the distance it *would move* in one minute, reckoned from the given time, and supposing its velocity to remain constant during that minute; that is, the dynamic force is equal to the weight multiplied by the velocity, as expressed by Equation 28, eighth paper, whether the velocity is constant or variable. A variable motion, then, is accompanied by a variable dynamic force. How about the static force which produces it?

In the case of falling bodies which have a uniformly accelerated motion, we know that the static force is constant, because it is measured by the weight of the body, and this does not vary, however far it may move or fall—within practical limits. A ball weighing ten pounds is urged downwards with a static force of ten pounds, by and in the direction of gravity, which is also the direction of its motion according to the second law. A constant static force, then, produces a uniformly accelerated motion. This has been thoroughly tested in the case of gravity. This conclusion we must also arrive at by comparing the first and second laws of motion with the effect that may be produced by a constant force.

In this discussion it should be remembered that we are not taking into consideration any friction or other resistance to the motion of the body, except the inertia of the body itself. Resistances to motion will be considered in another paper.

What is the motion of a body which is impelled by a static force less or greater than its own weight? To determine this, let us assume two bodies to be set in motion; the first falling or moving in obedience to gravity, and let g be its acceleration, which is known.* Let w represent the weight of the body. Suppose the second body to be moved by a static force, P, entirely independent of gravity, and having the same weight, w, as the first body. Let a represent its acceleration and F the dynamic force developed by the static force P.

Now, "change of motion in the direction of a force," spoken of in the second law, is measured by the acceleration which the force produces, since that is the velocity (change of motion) developed in the unit of time. Hence, according to the second law of motion, we have the proportion

$$w : P :: g : a, \text{ or}$$

$$29. \ldots\ldots\ldots\ldots\ldots\ldots w a = P g.$$

But according to Rule 28, eighth paper, $w a$ is the dynamic force of the body in motion, and a being its acceleration, it is called the *accelerating force* of the body. Hence, if we represent the accelerating force of any body by f, Equation 29 becomes

$$30 \begin{cases} \text{I}. \ldots\ldots\ldots\ldots\ldots f = w a. \\ \text{II}. \ldots\ldots\ldots\ldots\ldots f = P g. \end{cases}$$

Rule 30.—If any material body is acted on by any static force, the *accelerating force* developed in that body is obtained,

I.—*By multiplying the weight of the body by its acceleration*, or

II.—*By multiplying the static force, which produces the motion, by the acceleration of gravity.*

Example.—A ball of any weight is acted upon by a static force of 15 pounds; what is its accelerating force?

By the rule $f = 15 \times 115776. = 1736640.$ foot-pounds.

Multiplying both members of Equation 29 by t, we get

$$w a t = P g t.$$

Or, since $a t = V$ (Equation 13—III.) fourth paper), we have

$$31. \ldots \quad \ldots\ldots\ldots\ldots w V = P g t.$$

Now, V being the velocity at any time of the motion, $w V$ is the general expression for the dynamic force of the body, and since $w a t = f t$ (Equation 30—I.), we have

$$32 \begin{cases} \text{I}. \ldots\ldots\ldots\ldots\ldots F = f t. \\ \text{II}. \ldots\ldots\ldots\ldots\ldots F = w V. \\ \text{III}. \ldots \ldots\ldots\ldots F = P g t. \end{cases}$$

Rule 32.—To find the dynamic force at any time of a material body, moving with a uniformly accelerated motion and starting from rest,

I.—*Multiply the accelerating force by the time of motion*, or*

* In the fourth paper we should have given $g = 115776.$ feet a minute instead of 1929.6, etc.

II.—*Multiply the weight of the body by its velocity*, or

III.—*Take the continued product of the static force impelling the body, the acceleration of gravity and the time of motion.*

Example.—A body is set in motion by a static force of 15 pounds; what is its dynamic force at the end of ten minutes? From 32 (III.),

$F = 15 \times 115776. \times 10 = 17366400.$ foot-pounds.

Again, from Equations 29 and 30, we have

$$33 \begin{cases} \text{I.} \ldots\ldots\ldots\ldots\ldots\ldots a = \dfrac{P g}{w}. \\ \text{II.} \ldots\ldots\ldots\ldots\ldots\ldots a = \dfrac{f}{w}. \end{cases}$$

Rule 33.—Here we see that, if a body whose weight is w is acted on by any static force, P, the acceleration of the motion imparted to it is obtained,

I.—*By multiplying the force by the acceleration of gravity, and dividing this product by the weight of the body*, or,

II.—*Divide the accelerating force by the weight.*

Example.—A two-pound ball is thrown from the hand into space, the hand impressing a force of three pounds upon the ball; what will be the acceleration of the ball while so acted upon?

From Rule 33 (I.) we have

$$a = \frac{3 \times 115776.}{2} = 173664. \text{ feet a minute.}$$

Let us notice here that the acceleration does not depend upon the length of time that the force acts upon the ball, since a is only the *rate* at which the speed increases. If the force acts only one second ($\frac{1}{60}$ of a minute), or more than one minute, the velocity at the end of that time can be found by Rule 13 (III.), fourth paper, after the acceleration is known. In this case the velocity of the ball in one second would be 1929.6 feet a minute.

As long as the force acts on the body with a constant intensity, it will have a uniformly accelerated motion, according to the second law; and as soon as the force ceases it will move, thenceforth, with a uniform speed or constant velocity, as long as it meets with no resistance, according to the first law of motion.

From Equations 29 and 30 we get

$$34 \begin{cases} \text{I.} \ldots\ldots\ldots\ldots\ldots P = \dfrac{w a}{g}. \\ \text{II.} \ldots\ldots\ldots\ldots\ldots P = \dfrac{f}{g}. \end{cases}$$

Rule 34.—Knowing the weight and the acceleration, or the accelerating force of a body, to find the *static force* which gave it that acceleration,

I.—*Multiply the weight of the body by its acceleration, and divide by g.*

II.—*Divide the accelerating force by the acceleration of gravity;* the quotient will be the force required.

Equations 33 and 34 apply equally as well to retarded motion, in which case a is the retardation and P the retarding force.

Example 1.—What is the static force which develops an accelerating force of 173664. foot-pounds in a body?

Equation 34 (II.) gives

$$P = \frac{173664.}{115776.} = 15 \text{ pounds.}$$

Example 2.—How much static force is required to generate the unit of dynamic force represented in Fig. 24, eighth paper? Making $f = 1$ foot-pound in Equation 34, we get

$$P = \frac{1}{115776.} = .000008637 \text{ of a pound}$$

$= .000138192$ of an ounce.

This force will give to one pound of matter an acceleration of one foot a minute (Rule 33), which is required to produce a unit of dynamic force. Of course this force will generate a dynamic force of one foot-pound without regard to the weight of the body. If the body weighs one-half of a pound, its acceleration will be two feet a minute (Rule 33), and the dynamic force is one foot-pound, as before (Rule 30 or 32). Compare also Figs. 26 and 27, eighth paper.

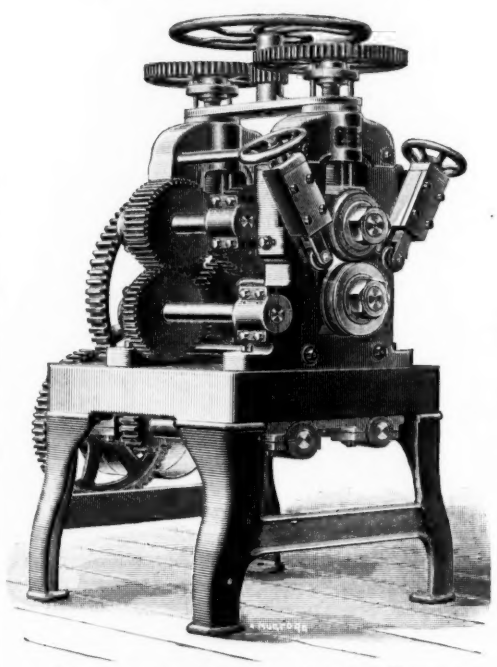
Machine for Forming Bicycle Tires.

We illustrate herewith a machine built by Blake & Johnson, Waterbury, Conn., for forming bicycle tires or felloes from tubing or flat strips of metal.

The machine consists of a table on which are frames holding a pair of arbors, with gearing as shown, and driving and loose pulley on the back of machine.

The upper or top arbor is adjustable; that is, it is so arranged that it can be raised or lowered by turning the hand-wheel on the top of the machine. The gearing is so constructed that, whatever position the arbors are in, the teeth of the gears retain their relative positions. The gears are all accurately cut from the solid metal. All shafts are steel, and run in long bearings. The arbors are made of steel, and the boxes nearest to the front of the machine are of composition metal.

The rolls or dies where the work is performed are on the ends of the arbors in the front. The form of the face of the upper roll is convex, and the lower concave, to give to the tubing or strip of metal the desired form. On either side of the rolls are adjustable slides, with small rolls, for the purpose of giving to the tubing or strips the circular shape to form the tire for a single wheel, the metal being cut into the length required for a wheel of a given size before putting it through the rolls. The machine shown in cut is designed for the heaviest tires used for bicycles; lighter and less expensive machines may be used for making the tires for children's velocipedes and baby carriages.



MACHINE FOR FORMING BICYCLE TIRES.

The Modern Steam Plant and its Management.

BY PETER H. BULLOCK.

MORE ABOUT ENGINE VALVE MOTIONS.

The last paper closed after a reference to the class of valve gears known as the disengaging valve motion. The most economical land engines of the present time seem to be of this class, and are those in which the steam valve is given a full opening at the commencement of the stroke, and remains so until closed by the regulating apparatus acting from its relative position attained by the speed of the previous stroke, for there are no engines fitted with disengaging gears that are sensitive enough for the point of cut-off to be influenced by any ordinary change of load that may occur during that particular stroke. In types of engines where the cut-off valve is not disengaged, but is always dependent for its position on the relative speed, it is quite possible for the amount of steam admitted at a certain stroke to be varied somewhat by the changes of load and speed occurring during that stroke. This is especially so in the case of a certain make, where the speed and the load both act on the governing apparatus—separately. That is, the cut-off valve will assume the proper travel to maintain the required speed at the load there may be on the engine at that time, but the amount of steam admitted may be varied according to the load, for the cut-off valve is also acted upon by the work being done through the fly-wheel, and more steam may be admitted to accomplish such work without there being any change in speed, unless the increase of load be more than the range of the secondary apparatus is able to supply, in which case the speed would be reduced, and both act together.

Many kinds of valve gears have been invented and put into use that had some one valuable feature; that is, they would accomplish some particular and perhaps desirable thing; but, in order to do so, some other more desirable feature, either of use, strength, or convenience would be sacrificed.

The different styles of plain valves, and those with riding cut-off attachments, were treated in the former paper, and the Corliss must be so familiar to all as to need no description. There are numerous styles of balanced valves, but many of them are so only in name. The attempts to balance slide valves too often run in the direction of complications, and most engineers have found out that, the less there is to get out of order, the better the valve, as a general thing. Probably the nearest approach to a perfectly balanced valve, under all conditions and pressures, is the double poppet valve, where both disks are of the same size, and the duty of the valve to admit steam to an inner chamber, which is surrounded on all sides by steam. Valves made like this are seldom found, however, as it is the more usual practice to make one of the disks small enough to pass through the seat opening of the other, this slight difference in size making it enough out of balance to overcome the friction of the stem in the stuffing-box, and effect prompt closing as soon as the opening cam or other means employed will permit it. I can certify to the excellence of this kind of valves when well made, for there is now running under my direction an engine having them, and which are tight after ten years' use.

The gridiron valve, so called from its having several parallel ports and bridges, is also a very good form of valve for some purposes. Its design and object is to secure a broad bearing surface, a large area of port opening, and a short travel for valve and stem. These can be used either for admission or exhaust, but, unlike many other kinds, one valve cannot be used for both purposes.

The term "rotary" is often wrongly applied to valves like the Corliss and others having an oscillating or rocking motion. A true rotary valve is one that is cylindrical, and that has one, two or more recesses or openings for the admission of steam. These are usually operated by gears adjusted so as to open at the proper time. Very few of these are to be found in use. With them the cut-off cannot be made automatically variable, and, as a type or class they have few if any advantages.

Some years since I had charge of an engine that had a slide valve of blunted U-shape, and which did as well, so far as running easy and keeping tight was concerned, as any valve I have ever seen. I do not know the name of the inventor or maker, but have always wondered why more of them were not in use. It was not claimed, so far as I know, to be a balanced valve, but it had more of the qualities of that class than many that are claimed as such. The bottom of the valve was flat and smooth, and the ports and recessed parts of the valve were in the inclined sides.

Piston valves have come into very general use during the past ten years, and are without doubt the best form of valve for high speed, and for that class where the speed is controlled by the variable travel of the valve, which in turn is determined by the relative position of the weights, springs and cams usually employed for this purpose. The prime requisites of this kind of governing apparatus is that the valve shell move with the least possible friction, and be quick and sharp in its action. Well made and proportioned piston valves are the nearest approach to these requirements of any yet invented. Their adoption and use for some of the heaviest marine service shows the wide range of work they are admirably adapted for. One valuable feature is the ease with which they can be examined, and, if necessary, replaced by new ones.

That so many and varied styles of valve motions as are to be found in the market at the present time are necessary, probably no one will claim, and, while it is a fact that some kinds and styles have some peculiar features that make them especially appropriate for some particular kind of work or conditions, it is also a fact that these engines are forever getting out of place, and we may find one that was designed to run a dynamo compressing air for rock drills in a stone quarry, and a fair saw-mill engine wasting the funds of the owner and the patience of the overseers in a four-set woolen mill.

This brings us to the point that an engine and its valve gear should be appropriate for the work it is to do and the care it is likely to receive. It is useless to put an engine with a fine finish and a complicated valve motion into a place where the surroundings are such, and the skill to manage it of such a character, that the finish is soon lost in an accumulation of dirt and rust, and the advantages that are supposed to come from the use of a correct valve motion are lost, from the fact that the parts are not kept in proper adjustment, or that adjustments have been attempted by those entirely unqualified to make them.

In examining a plant at one time to see why there had been quite an increase in the consumption of fuel, I found that the riding cut-off valve had been bodily removed from the steam chest, but the rod and valve stem were left in place to deceive. As the main valve was set square and had no cap, it will be seen that there was no wonder that they had been using four tons of coal per week more than usual. The engineer admitted removing the valve, and gave as a reason for so doing that the engine ran "stiff," and that it would not start unless stopped in a certain place. Here is a fellow who had rather burn half a ton of coal per day than to acquire the simple skill necessary to properly manage a very ordinary engine. He has never been promoted to run a better engine, and is always claiming that he has had no "fair show."

Some eight years since, while on an excursion to "Way-back," I saw a Corliss engine with its regulating apparatus disconnected and a throttling governor attached, when an expenditure of less than twenty dollars for parts, and a half day's labor by a competent man would have put the whole rig into proper and economical working order. Ignorance and inexperience on the part of those who had it in charge had caused several mishaps to the valve motion, and this being of frequent occurrence had induced the owner to abandon the "college professor" part of it, as he and the engineer were pleased to call the cut-off they had detached and disgraced; and the owner said, as he pointed to this monstrosity and monument to ignorance, that he still believed in the Corliss engine, but with the "Judson improvement," referring to the very good throttling governor he had attached. Now, it was of no use to that man to have an engine with a complicated, or, in fact, any other kind of a cut-off, for he had not the skill himself—nor sense enough to procure it—to manage his engine in an economical manner. He was content, inasmuch as his engine bore a good name and kept the saws going, and evidently believed that he had only removed some of the ornamental appendages and was still getting the benefits that are supposed to come from the use of an improved engine. Had the steam been generated with purchased fuel instead of mill refuse, it is quite possible that a little closer acquaintance might have been found desirable with the college professor part of the valve gear, and a less roseate view taken of the "Judson improvement."

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

FORTY-FIRST PAPER.

Mr. Shawk being the owner of the patent right for the steam generator that was the basis of the success of the first engine, felt himself secure against competition; but Mr. Latta, to avoid the patent claim, instead of increasing the size of the tube forming the coil, at a certain distance from the injection of the water, divided the tube into two tubes of the same size and again into four. This led to a suit by Mr. Shawk for infringement. An incident is recalled to my memory. Some time after this case had been decided in Mr. Latta's favor, the Hon. Thomas Corwin, ex-Governor of Ohio, etc., etc., accompanied me on a trip to Southern Illinois. At one of our stopping places, a number of the legal fraternity were congregated around the governor, and in course of conversation, a patent case, then pending, was referred to. Corwin was very free in expressing himself that no lawyer should be allowed to practice in patent cases who had not passed an examination by a board of mechanical experts; that there should be a separate U. S. Court for all such cases, presided over by a competent mechanical expert as judge. He went so far as to say that jurymen should be questioned as to their general mechanical knowledge of simple principles; he went on in his inimitable manner, to tell of how he and Judge Coffin, of Cincinnati, had made fools of themselves in undertaking to manage for a client a subject of which they were both profoundly ignorant; he cited it to show the uncertainty of law as administered, particularly in patent cases, and added that he had never been able to make up his mind as to who were the greatest fools—they in undertaking the case, the judge who tried it, or the jury who decided it, and gave a judgment of no infringement to the defendants. On my asking what case he alluded to, he replied, "Shawk *vs.* Latta, on a steam generator," then turning to his brother lawyers, he explained that the claim for Shawk's generator was a coil of pipe constantly enlarging, giving room for expansion of the water, and increasing the fire surface, by which certain results were obtained, or any other device to obtain the same result by means substantially the same. That Latta had obtained the same results with a tube of uniform diameter, by first dividing or branching that tube into two, and then four, and so on, and Corwin said that he and his associate were not able to make either judge or jury see that this was obtaining results by means substantially the same.

I was amused at the governor making so strong a case against himself to show the wisdom of his suggestion as to the mechanical training of patent case attorneys. When alone with him I found it difficult, in fact almost impossible, to make him understand that even if it was, as he supposed, Latta's object alone to evade the right held by Mr. Shawk, he had really made a great and important improvement, inasmuch as, by the constant increase of diameter of the tube in the Buchanan coil, the volume of water to be heated increased in a greater ratio than the increase of fire surface. But in Latta's case the exact opposite was the effect; for by dividing or doubling the tube, he doubled the area of fire surface acting on the same volume of water, increasing the capacity of the current, and making the application of the heat much more effective. When by use of pencil sketches, tables of circumference and areas of circles, it was made clear to him, he looked very serious as he said: "I see it now, and it makes me feel that I was a greater fool than I thought myself, if not a dishonest man, for could I have seen it in this light, I should have advised against the suit; but it confirms me in my view as to the necessity of a philosophic and mechanical training of lawyers admitted to practice "in patent cases."

While A. B. Latta was constructing the second engine, Mr. Shawk was also building one reducing size and weight, aiming to reduce cost—an important consideration in their successful introduction into general use. In his direct-acting steam pump, moving the valve of the steam cylinder by the direct action of steam on a separate piston was original with him, and he claimed to have been the first to apply it By the time these engines were completed, public sentiment had become so much in favor of a paid fire department, under the management of competent engineers with trained assistants, that council was prepared to act on it. A competitive trial of the Shawk and Latta engines was arranged for and took place, and the award for the quickest getting up and constant maintaining steam was in Latta's favor, and the city of Cincinnati adopted his engines.

Mr. Shawk failing to sell his engine "Young America" to the city, took it east, and exhibited its performance in Philadelphia, New York, and the principal Eastern cities; this being the first successful performance of the kind, must have been seen by, and is no doubt recollected by many hundreds of people still living.* I do not know what disposition was made of this—Mr. Shawk's engine—but on his return to Cincinnati he built several other engines before his death. Not long before this occurred, and during one of my visits to Cincinnati, I met him, and he insisted on my going with him to see his last engine, and he had it fired up to show me its performance. At this, the last interview I had with him, at times he was enthusiastic in showing what he had done, but on the whole he seemed depressed; he complained of the treatment he had received from the authorities of Cincinnati, which he did not consider just, after his early efforts and successful demonstration. I left him with the impression, that in pursuit of his *hobby* he had not been financially successful, and had expended the competency he had retired on from the lock business.

I do not know what disposition Mr. Shawk made of his engine, "Young America," or of the two or three that he subsequently built, but it is to be hoped that it is still in existence, but if not, that one of those that immediately followed it is. The old "Uncle Joe Ross," *the Shawk & Latta's joint engine*, being no longer in existence, *Latta's "Citizens' Gift"* and one of Shawk's earliest should be preserved, and the proper place would be the National Museum, Washington. As the British Government have preserved and have now standing side by side, in their patent office, "Puffing Billy," from the Darlington tramroad of 1812, that preceded the engine for the Liverpool & Manchester R. R. some 17 years and Robert Stephenson's "Rocket," that took the premium offered by the Liverpool & Manchester, in the celebrated contest, 1829. The value of such relics, as landmarks in mechanical advancement, cannot be overestimated.

It is fortunate for the credit of American inventors, that the engine and screw propellers of Col. John Stevens' little steamboat of 1804 are still to be seen at the Stevens Institute, Hoboken, N. J.

When I last passed through Cincinnati I was informed that the "Citizens' Gift" was still in service, but on calling at the engine house to see it, I learned that it was at the city shops dismantled, but my informant could not say whether for repairs or to be relegated to scrap heap—graveyard.

In writing a history of the progressive steps in that important invention, and successful demonstration of a practical steam fire engine, it has been far from my intention to detract from the just merit due to any of the parties connected with it, but simply to present the facts, and, if possible, do justice to one who had taken so active a part, and who, in the various published notices going the rounds of such papers as have been brought to my notice, has been entirely ignored. I will cite only a single instance that appeared in a shape calculated to incorrectly fix history. I refer to the *American Inventor*, an illustrated monthly paper published in Cincinnati, Ohio. In the number for July, 1887, on the first page, is a very good wood-cut representation of the engine built by Shawk & Latta. The superscription to this engraving is:

"The first practical steam fire engine, the 'Uncle Joe Ross,' A. B. Latta's patent, Cincinnati, O., 1852." Under it, on the same page, an excellent illustration of—

"The steam fire engine of to-day, built by the Ahrens Mfg. Co., Cincinnati, Ohio, 1887." In the text accompanying these engravings occurs:

"The difficulty to be overcome was the construction of a boiler so that it would raise steam in a very short time, and be capable of supplying a large steam pump continuously for many hours without failure, and not be liable, with ordinary skill, to explosion. Mr. Alexander B. Latta, of Cincinnati, O., was a man whose superior inventive ability and force of character particularly fitted him to solve this problem, *which he did* after trying many experiments, and expending a large sum of money. *His* first fire engine is shown by the old wood-cut; this engine was called the 'Uncle Joe Ross,' and was built in 1852 and tested January 1, 1853, and proved a triumphant success."

This is the engine that Abel Shawk proposed to build for the city after his successful demonstration with his Buchanan coil generator and patched-up model, and in building which he associated with him Mr. A. B. Latta, under the firm of Shawk & Latta.

On June the 6th, 1854, patent No. 11,025 was issued to A. B. Latta for "steam boiler water tube," the claim being as follows: "This boiler is composed of tubes, divided from 1 to 2, from 2 to 4, from 4 to 8, and so on, by letters A. B. B. Claim dividing of the coil or coils commencing with one, then dividing into two and three, subdividing into four or any other number as shown and described, or any equivalent device."

The illustration of beautiful and perfect steam fire engine, from the Ahrens Machine Works, of Cincinnati, O., the successors of Latta, shows in a remarkable manner how the improvements have run in the direction Abel Shawk was laboring for. The huge square fire-box has given place to a circular one possessing all the advantages of water space surrounding the fire, and to the skill and ingenuity of Mr. Ahrens is due the modification of Latta's patent multitubular or divided coil, adapting it to circular fire-box and boiler shell, the adoption of direct-acting vertical steam pumps, and the arrangement of frame and running gear has produced a machine of great durability, and filling all the requirements of a steam fire engine, and so compact and light as to be handled by two horses with ease and celerity, and so efficient as to throw a full stream from the nozzle within four minutes of lighting the fire.

I find among my memorandums of that time, some notes of the sizes and proportions of the first fledged, the "Uncle Joe Ross."

The wrought-iron lattice frame was 6′ 6″ wide by 18′ long—two carrying wheels in the rear, outside of the frame, with a single wheel in front pivoted to turn within the frame; two steam cylinders of 10″ diameter, 2′ stroke, arranged horizontally outside the frame, the piston rods that work the pumps which are double-acting of 6″ diameter, are direct from the steam cylinders and on the same horizontal line, and same length of stroke (two feet). There is a continuation of this arrangement, making the common locomotive outside attachment to the rear wheels as traction wheels, making the outside width of the machine about nine feet (9′). The exterior of the fire-box boiler is four and one-half (4′ 6″) square. I have no memorandum of its height; the smoke pipe projecting from the center of the square box—the internal arrangement; The Buchanan coil of *twelve hundred feet in length*, crossing and recrossing in sections, commencing near the bottom of the fire-box at 1¼″ diameter, increasing to 2¼″ where it discharges into the steam chamber; each pump has a suction of 6″ caliber, the same as the bore of the pump, and three ejection deliveries of 2½″ caliber, which are arranged three on each side of the front of the machine, so that each pump can throw from one to three streams. At an exhibition trial of this great engine I have witnessed six streams at the same time thrown through 1¼″ nozzle well onto the roof of a four-story building, and when both pumps were united to a single delivery through a 1½″ nozzle with very little elevation above the horizontal line, a considerable body of water was thrown a distance of two hundred and twenty feet (220′), all the steam for this great performance being generated within the fire-box with its twelve hundred feet coil.

From these sizes the magnitude of the machine and its performance, it must be evident to every one, that the birth of the first "practicable steam fire engine," differed greatly from the ordinary course of important mechanical achievements, and may be said to have come forth full grown and of magnificent stature—unlike the locomotive or steamboat, that grew from little to great, all improvements in the steam fire engine have been in the direction of reduction in size and weight.

For the quick generation of steam, there being no water in the coil, a quick-kindling fire being started, it becomes heated presenting a large surface on which a small quantity of water is thrown by a hand pump, steam is at once generated and the engine started that works the supply pumps, only differing from Hawkins & Perkins' efforts as early as about 1820, in not requiring the injection of the water to be in the exact quantity to furnish the steam for each and every stroke of the engine, but in excess, so that the coil and boiler fill when the supply is regulated as in ordinary boilers. I only refer to this to show the parallel lines in which inventors minds run.

*The Latta engine that followed the "Citizens' Gift," was named "Miles Greenwood," after the then city fire engineer, to whose perseverance and energy the abandoning of the volunteer system, and adoption of the steam fire engine, under a pay system, was mainly due. This engine was purchased by the city of Boston, the first city outside of Cincinnati to venture on the new-fangled machine.

Marking Iron and Steel.

Our British contemporary, *Iron*, makes a suggestion in regard to the designating marks of iron and steel bars and plates, which, though made with special reference to British practice, applies equally well in this country.

After calling attention to the utter uselessness, for any practical purpose, of combinations of stars, crowns and various other devices for indicating the characteristics of iron or steel, our contemporary suggests that a system of marking be adopted which will indicate at once the two things which an engineer usually wants to know regarding the material he proposes to use, *i. e.*, its tensile strength and ductility. These may be expressed in the form of a fraction, and we should then have such marks as $\frac{x}{y}$, in which x might indicate tensile strength, and y the extension under fixed conditions, or the degree of ductility. These marks would then mean something intelligible, and could, of course, be supplemented by such other special marks as the makers might choose to employ.

The Institution of Civil and Mechanical Engineers are recommended to take up this matter for England, and if our American societies could also take up the matter, and act in conjunction with the British societies to secure a uniform system of marking for the two countries, it seems to us that it would be a very good thing to do.

The *Chicago Tribune* says:

The only thing needed now to complete the Keely motor is a sort of curlicue to impinge against the jigmaree that keeps the doofliker in place on the resonator, and this cannot be provided without another assessment on the stockholders.

France has nearly 3,000 miles of waterway, navigable for vessels drawing 6½ feet of water.

A Coal-saving Device.

The accompanying illustration represents a coal-saving device, invented and patented by Mr. John Ham. The device is applied to the class of boilers here shown, by removing three courses of bricks from the lining at each side of the furnace, extending from near the front of the boiler to the bridge wall, generally beginning with the fourth course above the grate bars. In the channels formed by removing the fourth, fifth and sixth courses of the lining, fire-clay boxes are inserted; these boxes are perforated on the side next to the fire, as shown in the illustration. A wrought-iron pipe connects the end of each box to one of the boiler flues; at the opposite end of each of these flues a wrought-iron pipe is attached, extending to the outside of the brickwork. Air flows into these pipes, and is heated to a high temperature in the back connections; in passing through the flues, some of the heat taken up by the air is transmitted to the water, but the temperature of the air is again raised, as it passes through the pipes leading into the clay fireboxes, supplying the latter with air of about 700 degrees of temperature; the admission of this hot air to the furnace above the grates, and near the fuel, serves a very useful purpose.

The heat-producing elements of coal are carbon and hydrogen, and the principal product of its perfect combustion is carbonic acid, which is formed by the chemical union of two equivalents of oxygen with one of carbon. This acid, necessarily at a very high temperature, will, in passing upwards through the body of incandescent solid matter, take up an additional portion of carbon, and becomes carbonic oxide, which is the chemical union of one equivalent of oxygen and one of carbon. By the conversion of carbonic acid into carbonic oxide, heat is actually absorbed, while, also, the portion of carbon taken up during such conversion will be lost if allowed to escape in this form. Therefore, if the carbon, either of the gas or of the solid matter, passes away in union with oxygen, in any other form than that of carbonic acid, a loss of heating effect is the result.

The object of the coal-saving device is to reconvert the carbonic oxide into carbonic acid gas by the process of combustion, and for this purpose the air, heated in the fire-clay boxes to a temperature high enough to secure ignition, is allowed to mingle in the furnace with the carbonic oxide, supplying it with required volume of oxygen for forming carbonic acid. It is claimed that this device secures its object in an effective manner, and that a considerable saving of fuel is effected.

Another advantage claimed is that the gas, being nearly consumed, little, if any, can escape from the furnace and fill the building; consequently, for schools, factories and public institutions, the device is valuable as a sanitary measure. Modifications in this device are made so as to adapt it to the different kinds of boilers and settings. It is applied to furnaces by W. Foote & Son, 9 South street, New York; this firm also owns the patent.

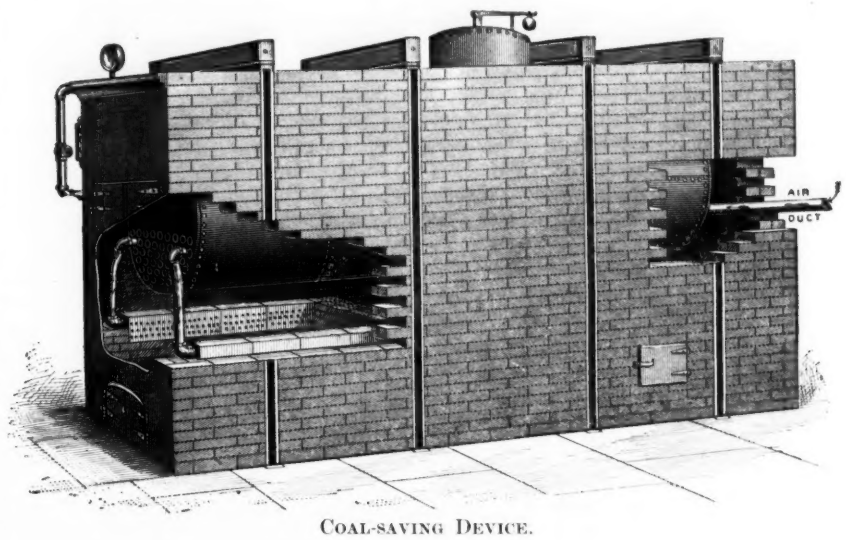
Almond's Loose Pulley Oiling Device.

With this we give illustrations of a new method of loose pulley oiling, devised by Mr. T. R. Almond, of Brooklyn, N. Y.

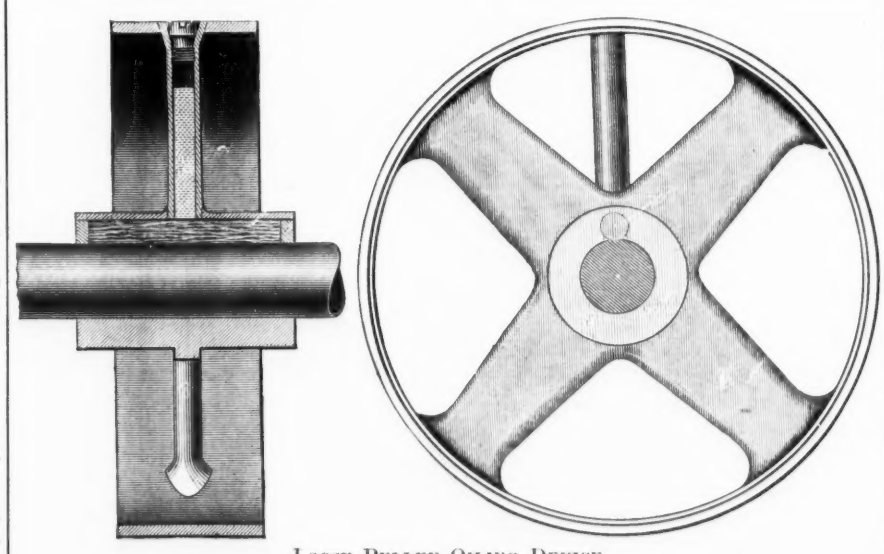
Mr. Almond in his own shop experienced the usual difficulties and annoyances attending the use of loose pulleys, and, after some experimenting, devised this method, which has proved entirely satisfactory; one loose pulley, which is on an upright drill press used intermittently, having run for the past six months without any attention whatever, and seems still to be well lubricated.

A hole is drilled through the hub of the pulley from side to side, parallel with the bore, and this hole is connected with the bore by a slot about $\frac{1}{8}''$ wide. Both ends are plugged with short pieces of wood, and it is filled loosely with cotton wicking or wool.

A small tube is fitted to extend from the rim to the hub, connecting with the hole through the hub, and the upper end of this tube is fitted with the usual screw. It is thus seen that the appearance of the pulley is not changed, and the supply of oil is constant and does not overflow, oiling the belt and causing a waste of oil. The hole through the hub is made $\frac{5}{16}''$ to $\frac{3}{8}''$ diameter, according to size of pulley, and pulleys so fitted up do not require oiling more than once a month.



COAL-SAVING DEVICE.



LOOSE PULLEY OILING DEVICE.

LETTERS FROM PRACTICAL MEN.

Making Money Without a Draftsman.

Editor American Machinist:

In your issue of January 9, I note your editorial on "The Advantages of a Well-organized Drawing-room." Bearing on this subject I wish to call your attention to the fact that one of the largest manufacturing establishments in Philadelphia, making *more money* than any other establishment in the country, has no draftsmen, nor has it any drawings, either of its machinery or the location of its machines.

This workshop is called the Mint of the United States.

About four years ago I was called in by the then Superintendent to give an opinion as to a charge made by some one furnishing machinery for a special purpose. At that time I called the attention of the Superintendent to the fact that, in one man and his technical knowledge, he was possessed of the only means of carrying on certain parts of the establishment. Soon after I met the Director of the Mints, and once more urged the introduction of one draftsman who could make such drawings as the master mechanic required, and who at odd times might copy all the machines in use, for the purpose of controlling the situation, and making the establishment independent of the few men who could supply the wants of the coining department.

The Mint of to-day is about as Mr. Peale left it, after having, while Chief Coiner, designed most of the present machines.

The Mint in Mexico, under private management, has machinery that enables the hand adjustment of weight of cast coin to be done away with. The methods to this end are well known to experts, but in a city noted for its mechanical establishments, and the perfection of its output, methods obtain in practice that have been given up, to great profit, in the Mints under private contract.

If you know the very worthy gentleman Uncle Sam, it would be well to send him a marked copy of your paper, and tell him that his show manufacturing establishment for making money would be the better for at least one draftsman whose yearly wages would help to make money more profitably.

COLEMAN SELLERS.

Grindstones and Emery Wheels.

Editor American Machinist:

When a man differs from most other men in opinion on any subject whatever he is usually called a crank, and the fact that his opinion may be right, and all the others wrong, makes no difference; he is a crank anyhow, at least until his opinions win the day, when every one says he always thought the same thing.

Now there are very few people who enjoy being called cranks, and I am not one of them. I don't mind it so very much, but still I would prefer being called something else, like "Judge" or "Colonel," for instance. It is for this reason principally that I am glad to see Prof. Sweet take up the question of grindstones and emery wheels, because I have maintained all along that a grindstone, if given an equal chance, was a much better thing to grind lathe and planer tools on than any emery wheel ever constructed. This opinion of mine has been one among other evidences upon which has been based a suspicion that I am a crank, and I therefore rejoice to see such a man as Prof. Sweet taking the same view of the question, because it tends strongly to relieve me of the suspicion above alluded to.

And speaking of cranks reminds me that grindstones used to be turned by cranks, and they are still turned in that way in country blacksmith shops, and on the farms. And on the farms it seems always to be considered a boy's job to turn the grindstone; and yet there is no job of work done on a farm where a man's strength is more needed, or where it would pay better, as compared with a boy's strength. And it seems to me that most of our machine shop managers have got their ideas of grindstone driving directly from the farm. What other conclusion can be arrived at when we see a four-foot grindstone driven by a rotten old belt which has served its time on the bolt-cutter, and become useless for any purpose whatever, running over a 10" pulley on the grindstone shaft, and a chunk of wood on the line shaft, because no pulley was to be had small enough to drive it sufficiently "slow, so the water won't fly off." The farmer's boy could do just as good a job of grindstone turning, and just as much work would be accomplished by those who used it. This sort of a grindstone, with its wooden boxes and generally good for-nothing arrangements, is responsible more than anything else for the miserable, ill-shapen lathe and planer tools found in so many shops. A man grinds tools "only where they are dull," simply because life is too short and his back won't stand the strain of grinding them as he knows they ought to be ground.

Just here came in the opportunity of the emery wheel man. He built a good machine for his emery wheel, made provision for getting plenty of water onto it and for preventing it from flying about the shop, and *specified the speed at which the machine should be run.* Of course he beat the farmer-boy method of grindstone driving all hollow, and it would have been a most surprising thing if he hadn't. But was his victory due to the substitution of the emery wheel for the grindstone, or to the substitution of the sensible and rational method of driving for the farmer-boy method? Those who give the thing a fair trial will find the answer to this problem, and some of them may be greatly surprised by it.

I once worked in a small machine shop where, the tools and all appliances being of the best, the old wooden box half full of mud wouldn't answer for the grindstone, and a modern cast-iron box on rollers took its place, this box being cleaned out every Saturday afternoon. The grindstone was driven at the usual farmer-boy rate, and when a small nick got broken out of a tool the problem was to decide whether most time would be wasted by wearing it off on that grindstone, or by going to the tool dresser and having it softened so that it could be filed off. But this small machine shop was a part of a large manufacturing establishment, in one department of which the work was done entirely by grinding. And since the amount of work done in that department depended entirely upon the efficiency of the grinding operations, the hundred or more grindstones used there were mounted and run as if for business; in fact, they were driven at a speed that occasionally sent fragments of grindstone through the roof, and distributed them about among the neighbors.

I went round that way from the tool dresser's forge one day with a new diamond point tool which the tool dresser had failed to make in the shape I wanted it, and which I knew would take lots of time and lots of backache to shape up on the machine shop grindstone. I put it on one of those flying stones, and could actually feel the steel being ground away. It was reduced to shape more quickly than the tool dresser could have forged it to shape, and after that, when I had *grinding* to do I went out there, while if I merely wanted to whet up a little the machine shop stone would do if I wasn't in too big a hurry.

I often wondered why those two kinds of grinding apparatus existed in the same establishment. This was in the days before the emery wheel tool grinder era, and when afterwards, in another shop, I ran across the first machine of that kind and tried it, I felt very sure that I knew of a better thing, and that that better thing was a properly mounted and properly driven grindstone.

I expect if I could look into that small machine shop to-day I would see there a modern emery wheel tool grinder in place of

the grindstone, because you see that establishment is progressive, you know. But do you suppose I would find emery wheels in place of the stones in the grinding-room? I should as soon expect to find Arkansas oil-stones. FAY.

Temperature and Chimney Draught.

Editor American Machinist:

Replying to the inquiries of Prof. Denton,* I am sorry that the observations of the chimney draught were not more complete, and a record made, as a matter of interest to mechanical engineers on this subject.

1st. The amount of coal that could be burned on a square foot of grate, when the melting furnaces were not running was about 15 pounds. When the melting furnaces were running, the amount that could be burned was over 25 pounds.

2nd. These amounts were determined by weighing the coal in both cases.

3d. The boilers were set in a row, and the nearest was about 10 feet from the chimney, and the farthest was about 50 feet.

The melting furnaces were placed at right angles to the main flue, and this flue was 50 feet long.

4th. There was no obstruction in the flue of the casting furnaces. In the flue from the boilers there was the usual damper for regulating the draught. This damper did not close tight, but was calculated to allow sufficient gas to pass off when closed, to prevent any coming out in the room. At one time, we ran the engine nights for a time, and the work required but two boilers.

The melting furnaces started at midnight. The first part of the night this damper was regulated by the regulator, and was partially open most of the time. When the melting furnaces started this damper would be closed as tight as possible, and the dampers on the boilers partially closed, to prevent raising too much steam.

5th. No fan was used about the place, all the furnaces depending on draught alone.

6th. The temperature of the chimney was not determined at any time within the chimney shaft, and for this reason it will probably be claimed that this story is of no value.

If we were running under the same conditions now, I would have careful observations made on all these points. In the other case mentioned the boiler flue is not over three feet long, and the flue from the annealing furnace is so close that the flame from the same enters the chimney.

I would say in connection with this that it has seemed to me a matter of small account whether 600 degrees was the limit or not, as no one could afford to put gases into a chimney from a boiler as high as 600 degrees, but from my own observation it has seemed that the 600 degree limit was a fallacy. W. E. CRANE.

Differential Indexing.

Editor American Machinist:

Having read the articles on differential indexing, and thinking that another method of indexing, by which *any* divisions could be indexed, might be of interest to you, I will attempt a description of it. Some time ago, having occasion to do some indexing for which no plate was at hand, I devised a way of doing it decimally, which has since proved quite useful at times. I cut out a brass ring *A* to fit over the rim at back of index head and divided it into 10 equal parts; by this means the first figure of decimal is read, a point *B* was marked on head to count from. Next the index plate was divided into 250 equal parts, and figures stamped on to show each $\frac{1}{100}$ turn of spindle: $\begin{matrix} 0\ 1 \\ 5\ 6 \\ 10 \end{matrix}$ etc.; these figures show the second figure of decimal, the finest graduations show the *fourth* figure of decimal, the fifth is approximated. A brass plate *C* was then made, to move freely around index plate, and large enough to cover the distance equaling $\frac{1}{100}$ turn of spindle, and divided into 10 equal parts, the graduations of which show the *third* figure of decimal. A pointer *D* was also attached as shown.

*Letter forwarded to Mr. Crane from this office.

If it is desired to cut a gear having say 53 teeth, the brass plate *A* and pointer *D* are brought to 00000, and the first cut taken, for the next cut the pointer and plate *C* is moved to correspond with the decimal of $\frac{1}{53}$ (.01886), which point is shown in sketch. I find the decimal for each succeeding division by adding the above decimal to the previous sum. This method may be old, but as I have never heard of it, I'll take the chances

Brooklyn, N. Y. G. S. HAWKINS.

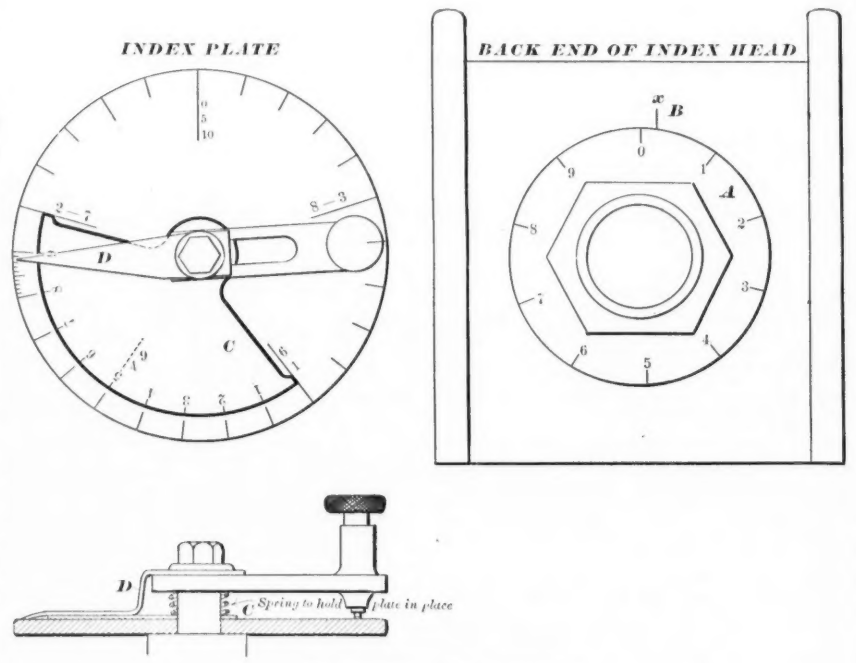
Round or Square Chimneys.

Editor American Machinist:

Having planned and erected nine chimneys for boilers, I would say that the best I ever constructed was for the Waterbury Watch Co., having a round flue, gradually increasing in size from base to top. This chimney was erected by a mason who claimed to have erected all the chimneys in Waterbury, and he pronounced it the best draught of all he had built.

As a guide in laying a round core, I made a drum of proper diameter, six feet in length, in the center of which was a hole, through which was hung a plumb-bob, which was kept hanging over an iron bolt set in the center of the foundation. To secure uniform gradual increase of size, I tacked onto this drum, after the chimney had been carried up about ten feet, laths which had been reduced to $\frac{1}{16}''$ in thickness, placing them a lath apart. Bricks were laid against these laths, consequently increasing the size of the hole. After laying ten feet more, laths of $\frac{1}{8}''$ thickness we placed between the first laths, and the chimney carried on ten feet, and I continued doing so until I reached the top of the chimney. The working of this chimney decided me to always build chimneys with round flues, with a gradual increase of size. A. WEBSTER.

Waltham, Mass.



DIFFERENTIAL INDEXING.

Tests of Spiral Springs.

Editor American Machinist:

In the AMERICAN MACHINIST for January 7, '88, Mr. J. Begtrup gives formulæ for proportioning spiral springs as follows:

(A) For carrying capacity:

$$W = .383\ \frac{S\,d^3}{D_0} \text{ for round steel.}$$

$$W = .471\ \frac{S\,d^3}{D_0} \text{ for square steel.}$$

(B) For deflection of a single coil:

$$F = \frac{8\,P\,D_{0^3}}{E\,d^4} \text{ for round steel.}$$

$$F = 4.712\ \frac{P\,D_{0^3}}{E\,d^4} \text{ for square steel.}$$

Where W = greatest carrying capacity in pounds.
S = greatest tensile strength in lbs. per square inch.
d = diameter of steel used in inches.
D_0 = mean diameter of coil.
F = deflection of one coil.
E = torsional modulus of elasticity.
P = load on spring in pounds.

He also gives the records of tests of three springs made of $\frac{5}{16}''$ and $\frac{1}{4}''$ steel with nine, ten and eighteen coils respectively, under a load of 100 pounds. He tested his springs for deflection only, and obtained results which agreed very well with the calculated ones.

I recently had some springs made for a particular purpose, and took the opportunity to check their observed deflections against the calculated results, and, thinking the results may be interesting, I give them here.

The springs were 6" long, with 20 coils exclusive of end coils.

Mean diameter of coil, .575".

Diameter of wire used, .1375".

Load, 40 pounds.

In calculating the deflection, I used Mr. Begtrup's value—12,000,000 for the modulus of elasticity of steel—and the results seem to show it to be a pretty reliable value.

The two springs tested gave exactly the same deflection in millimeters for 40 pounds load, namely, 7 millimeters. This equals .27559" for twenty coils, and .01377" for one coil.

The calculated deflection was .01418" per coil. The difference is .0004" or 2.82 per cent.

This is "within three per cent.," and I believe that was the accuracy claimed by Mr. Begtrup.

These tests may be interesting as showing that the deflection formula at least *may* be reliable for small sizes as well as medium. I intend making some more tests immediately on smaller and larger sizes of steel, and will give the results when they are ready. I shall try and test some of the small and medium sizes for carrying capacity, but anticipate considerable trouble in doing so, and much less satisfactory results.

J. TORREY.

Counterbalancing Engines.

Editor American Machinist:

A letter from J. P. Noyes in the AMERICAN MACHINIST of December 5th, calls attention to the question: Can a diagonal engine be perfectly balanced? The answer to this is that, apart from such disturbance as may be due to the angularity of the connecting rod, a pair of diagonal engines coupled in the same plane on one crank-pin can be perfectly balanced by a single weight, or rather pair of weights, opposite the crank. In such an arrangement the excess of balance transversely to the motion of the piston of one cylinder comes in to balance the other piston, etc., and conversely. The arrangement is not new, neither is the knowledge of the perfect balance attained. It is, however, well worth notice that an arrangement which does introduce a transverse disturbing element, in order to full balance the rectilinear moving parts of an engine, is cured by another similar imperfect appliance being quartered upon it. Does not this afford a fairly strong or conclusive evidence that it is perfectly possible to balance the piston and other straight moving parts of an engine by a revolving counterweight? Some engineers tell us the practice is bad, but here we have a case where when full balanced and corrected for transverse non-balance only, a pair of engines are between them perfectly balanced. It is clear that straight moving parts can be balanced, but it is equally true that the revolving weights do introduce transverse action—which is vertical in direction in locomotives—and that such action is most serious in its effects on bridges when the engine at fault is a locomotive.

In quartering two engines on one crank-pin the connecting rods need arranging so that one has a single end and the other a fork end, in order that both may center on the same line.

The balance weights should be arranged equally on each side of such center line in disk or fan-tail cranks, if so convenient, but in single-arm cranks one weight needs to be the fan-tail and the other to be disposed on the wheel as given in recent article. *Perfect* balance can alone be obtained by means of the slotted crosshead, as Mr. Noyes suggests.

W. H. BOOTH.

Emery Wheels vs. Grindstones.

Editor American Machinist:

Allow us to partly confirm Prof. Sweet's letter in your issue of Jan. 9th, and at the same time to vindicate the emery wheel, and the wheel maker. In a lecture delivered by the writer of this, on Dec. 9, 1889, before the Franklin Institute, Philadelphia, the increasing use of wet grinders was criticised as an unwise reaction. The fact is that the getting up of machines for wet grinding has been mainly done by people who wanted to sell machines, but not by practical emery wheel makers. It is our own belief that, while wet grinding may be necessary in a few cases, it is the use of soft, free cutting wheels, run dry and at high speed, which characterizes the great advance made in the substitution of the wheel for the grindstone. We have always felt that the man who used an emery wheel wet failed to get the wheel's best work, and that the reputation of the wheel suffered.

Our company [The Tannite], we believe, was the first emery wheel company to take up the manufacture of grinding machines, yet we have never put on the market a wet tool grinder. We have been beset for years by agents, salesmen, clerks and dealers, to get up such machines, because they would sell; and we have refused, on the ground that, if they did sell, they would damage the emery wheel reputation and business.

Undoubtedly if grindstones were better mounted and treated they would do better, but we cannot believe that the best grindstone, treated in the best way, will even compare with the best emery wheel. Poor grinding machines will wear out, and coarse, hard wheels may use up diamond tools, while a good grindstone well mounted is a most valuable tool. Nevertheless, we wish Prof. Sweet and others would see how much they could accomplish with sharp emery wheels, run dry, and a cup of water to dip the tools in. T. DUNKIN PARET.

The *Engineer* (London) has the following:

A South Wales paper says: "The announcement that the s. s. China, which left Barry Dock on October 2d, had reached Hong Kong in the short time of 33½ days—thus beating the overland mail—is of more importance to this district than would at first sight appear. The China is a steamer of 10,000 tons burden; was built on the Clyde, and came thence to South Wales to be coaled for her long voyage. She received 2,500 tons of best—Ocean Merthyr—quality, and her quick passage has demonstrated once again the excellence of that coal, which combines all the good characteristics that distinguish the Welsh product. She is the first of a line of steamers designed to develop trade between the United States and the Chinese empire. Several other vessels of similar large capacity are being built in Great Britain for the same line, which is an undertaking of the noted financier, Mr. Jay Gould."

An Improved Belt Holder.

The accompanying illustration is of a new belt holder which is intended to be bolted to any suitable support in the same manner as a hanger, and in such a manner that the rollers shown at the left conform to the circle of the driving pulley on which the belt runs, these rollers being adjustable for that purpose. The curved plate, in which are set the studs that support the rollers, is movable upon the main casting, being held by bolts which pass through a curved slot, thus making it adjustable to suit any position of belt. The belt passes through the eye shown in front, by which it is guided onto and off the pulley, and in addition to this there is a pusher at the back, which is moved by the same movement of the shifting lever, and helps to place the belt on the pulley. A spring catch holds the shipping lever in either position.

It will be understood, of course, that, by the use of this device, a machine which it is desired to stop during working hours has its driving belt shifted off the driving pulley onto these rollers on which it lies at rest, thus relieving the line shaft of all belt strain, and the belt of all wear. Moreover, the power consumed in driving the loose pulley and the friction caused by the belt is saved. The pulley on the line shaft need be only half as wide as where nothing of the kind is used. As will be seen, this makes a simple, neat and efficient device for the purpose. It is made by Jackson, Cascaden & Whitcomb, Manayunk, Pa.

BELT HOLDER.

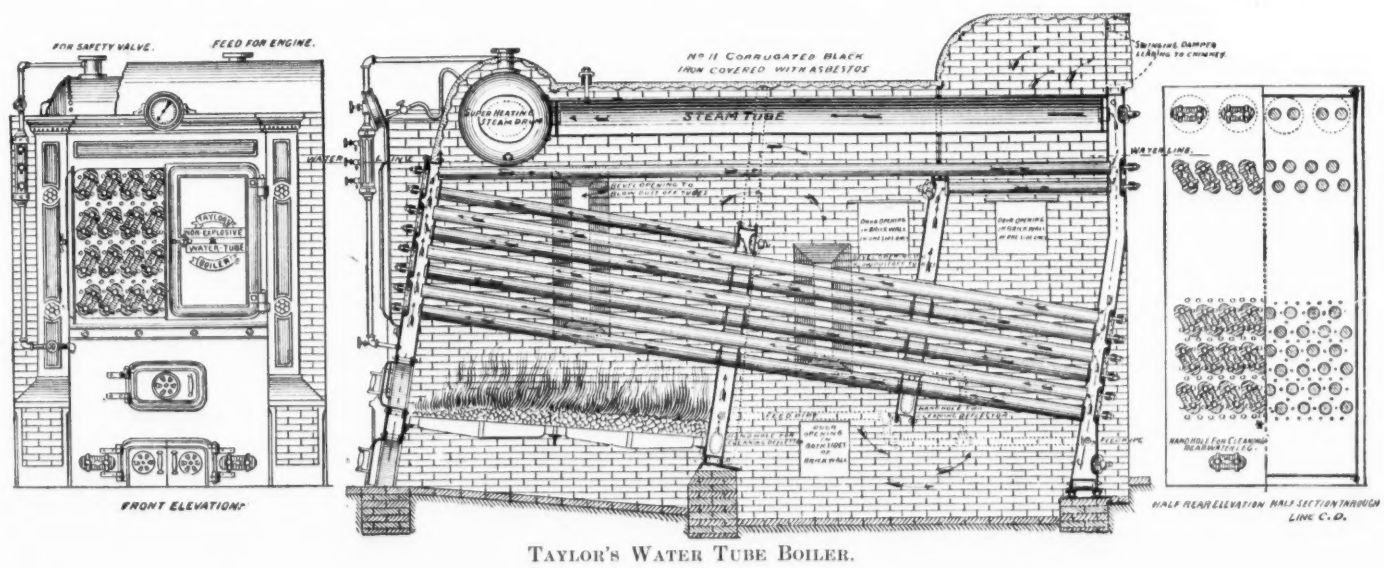
Taylor's "Non-explosive" Water Tube Boiler.

We illustrate herewith a water tube boiler, designed by Mr. John Taylor, of Troy, N. Y., constructed entirely of steel plate and lap-welded tubes, and designed for very high pressure.

The front is constructed of two plates of wrought-iron or steel secured together by stay rivets passing through sleeves. The outside plate having oblong hand holes placed obliquely, giving access to each pair of tubes, which are expanded in staggered order in inside plate. The furnace and ash-pit doors are made in the ordinary way, and provided with dampers; there are also hand holes at bottom, to allow for cleaning.

The rear is made the same as front, except that it is widened at bottom to receive the sediment, thus taking the place of the ordinary mud drum, and is mounted on rollers, which accommodates the expansion and contraction.

The flame deflectors or water backs take the place of the ordinary brick bridge wall, and flame plates that are commonly used, and thus utilize the heat striking them to generate steam. They are constructed of two plates of wrought metal that extend across boiler, and are provided with nipples of extra heavy tubing expanded in both plates, as shown, permitting the tubes to pass through them freely. They are provided with a course of short tubes which connect them to the front and rear. Opposite each pair of these tubes are hand holes placed horizontally. The bottom is provided with hand holes for cleaning, which are placed at the sides, so as to be easy of access. The four large steam tubes are made without rivets, the heads being welded in and provided with two nipples in each end, as shown. The ends next to drum are carried by a round piece of iron tapped in them, and provided with a cap and nut, which are supported by two bars of iron that extend across boiler and rest on sidewalk.


FOR SAFETY VALVE.
FEED FOR ENGINE.
No 11 CORRUGATED BLACK IRON COVERED WITH ASBESTOS
SUPER HEATING STEAM DRUM
STEAM TUBE
WATER LINE
TAYLOR'S NON EXPLOSIVE WATER TUBE BOILER
FRONT ELEVATION.
WATER LINE
HALF REAR ELEVATION HALF SECTION THROUGH LINE C.D.

TAYLOR'S WATER TUBE BOILER.

The superheating steam drum is constructed in the ordinary way, with bumped heads, and reinforced with a heavy plate to receive the nipples of steam tubes. It is provided with manhole, which gives access for expanding said nipples.

The water circulates as follows: It is fed to rear leg and deflectors through feed pipe; as it becomes heated it passes up inclined tubes to front leg where it commingles with water from front deflector and rises to top, then returns through top course of tubes to top of rear leg, becoming vaporized in its passage, the water descends through leg, and re-enters the tubes; the steam rises and enters the large tubes through nipples, and continues into the steam drum, where it is thoroughly superheated, as drum is located directly over the furnace.

The boiler is easily repaired, as every part can be gotten at readily, and can be cleaned or examined both inside and out. The parts are constructed and tested in shop in separate pieces, and it is erected in place where it is to be used by simply expanding tubes in position.

There is a large steam space, viz., the four large steam tubes and the superheating steam drum. It has large heating surface, and it is claimed will develop more power than any other style of boiler occupying the same amount of space.

It has a large combustion chamber, and has no corners or air pockets that interfere with the draught, but the heat and flame have access to all the internal parts of boiler.

The non-explosive feature is very simple and effective. One of the water tubes located in the center of lower course (marked * in rear elevation) is made thinner, and so of less strength than the other tubes, but is tested to resist a pressure greater than that required in the normal use of boiler, whilst the other tubes are tested to resist a still greater pressure. Should the pressure for any reason exceed the strength of the weak tube, it will, being the weakest point of boiler, yield and split open, allowing the water to extinguish the fire; the only result being the destruction of this thin tube, which is easily replaced.

She—What do the papers mean by the underground electric system?

He—The underground electric system is just the reverse of the one now in use. It is a system in which it is proposed to bury the wires instead of the citizens.—*Life*.

Hydraulic Power.

The New York Hydraulic Power Supply Company, lately organized, has applied for a permit to lay mains and pipes through the streets of New York City for the purpose of furnishing hydraulic power in all cases and places where hydraulic power can properly be used in any way for useful purposes. The company has also filed a map showing distribution of mains, location of main pumping and auxiliary stations, and drawings of pumps, boilers, and details of the main pumping station. Undoubtedly there will be considerable opposition to this project, for the simple reason that people are tired of seeing the streets of the city torn up, and traffic in many places impeded. But if the city will gain more by adopting this project—and we believe it will—than it will lose by a temporary obstruction to traffic, a permit for laying the mains and pipes should be granted.

Hydraulic power for handling merchandise is used with success in many of the large commercial cities of Europe, and other sections of the world; it has superseded other systems in all the large English ports. Indeed, it cannot now be considered to be a new plan, nor one of untried or doubtful expediency—it has passed the experimental stage. The advantages claimed for the hydraulic power over other systems is the increased rapidity with which vessels can be unloaded, and the decrease in cost of doing the same. From the first-named advantage, others follow; for instance, the time saved by ship owners and merchants, especially in the case of perishable cargoes, is of great importance; also an increase in the rapidity of handling merchandise means an increased capacity of wharfage. Again, if warehouse owners are enabled to handle their merchandise without steam power on their premises, they will diminish the risk of fire.

When a system of this kind is properly laid, it is reasonable to expect that its action will be certain and constant, and easily maintained at its full efficiency without frequent overhauling and repairing. The supply of water to be used is not to be taken from the Croton nor from any supply of the city, but from wells. This subject, the company claims, has been very fully investigated, and they have guarantees from experienced well-drivers of a supply equal to the requirements, and will not conflict in the remotest degree with any system of water supply. The mains are to be ten inches diameter, and the pressure, 750 pounds per square inch. Although this high pressure of water will not be valuable directly for fire purposes, the power in it can, by a simple arrangement, be made to throw a powerful stream of any other water.

The danger from leakage is small; to support this assertion the company refers to the hydraulic system now in operation in London, where more than thirty miles in length, laid under great difficulty, and having more than 1,100 machines in connection with it, has about three per cent. only unaccounted for, and, therefore, nearly the entire quantity must be credited to the consumers' machines and their connections.

Explosions of the pipes of the hydraulic system, causing the upheaving of streets, are almost impossible; if a leak occurs it does not always show itself on the surface, and must be located by indirect means.

The soil around the pipes will not be heated up, to the detriment of electric wires, nor can it heat the foul gases in sewers, making them more obnoxious than they would otherwise be. In consideration of these advantages it seems to us that the commerce of the city of New York will be greatly benefited by the introduction of hydraulic power; but before it is adopted the company should be compelled to furnish ample security for laying the mains and pipes with dispatch, so that the temporary obstruction to traffic will be reduced to a minimum. The company should be compelled to submit all the plans of construction for approval by the Commissioner of Public Works, or the Sinking Fund Commissioners, or such other public officers of the highest engineering abilities as the Board of Sinking Fund Commissioners may see fit to designate. The company should also be compelled to use the best material, and the best joints that can be had, and demonstrate to the proper authorities that the pipes are perfectly capable of sustaining not only the proposed pressure of 750 pounds, but say 2,500 pounds per square inch, and that all pipes and connections used shall be tested to the latter pressure before they are put in the ground. With the employment of the best engineering skill the distribution of hydraulic power can be made as successful in this city as it is in England, Scotland, France, India, Australia and other places.

Tests of Steel Treated by the Redemann-Tilford Process.

In regard to the tests of steel treated by the Redemann-Tilford process, C. W. Hayes, of Washington, informs us that the tests were made upon two duplicate plates of solid rolled steel, 30″x30″x6″. One of the plates was treated in the Redemann-Tilford chemical bath. The treatment was for the purpose of making one side of the plate, for a depth of three inches, drill-proof, leaving the other three inches soft. The other plate was not treated in any way.

After a trial of six hours, and failures of drills and slotting tools, the plate that had been submitted to treatment was found as hard as expected.

Then the two plates were placed side by side, and submitted to tests of shot from a Hotchkiss and other guns. A three-pound shot from the Hotchkiss gun penetrated the untreated plate 1½ inches, and the treated plate ½ an inch, and a six-pound shot penetrated the untreated plate four inches, breaking it, while it penetrated the treated plate only one. Other six-pound shot penetrated the treated plate 1½ inches.

A one-hundred-pound shot, fired from a 6″ gun, 49 lbs. powder, striking velocity 2,103 feet per second, struck the treated plate at the corner, about 7 inches from the top, penetrating the plate about 3 inches, breaking the shot and edge of plate.

Traveling salesmen have their organizations, known as Knights of the Grip. There ought to be no trouble in getting recruits hereafter.

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The Supply of Natural Gas.

Prof. Orton, of the Ohio State University, who holds the position of State Geologist of Ohio, has come to be regarded as an authority on matters pertaining to natural gas, having as a geologist made an especial study of the subject. He read an interesting and important paper on the subject, at the recent meeting in this city of the American Geological Society. The paper was entitled: "The Origin of the Rock Pressure of Natural Gas in the Trenton Limestone of Ohio and Indiana," and it was an answer to those who claim that the natural gas fields are practically inexhaustible, and that, by subterranean chemical combination, nature is manufacturing the gas as rapidly as it is being used.

Prof. Orton's conclusion is that the natural gas supply of Ohio and Indiana is not only not inexhaustible, but that it will probably actually be exhausted in about nine years. The gas is the product of ages which has been accumulated in the porous limestone rock of Ohio and Indiana, its production having been so slow that, when once exhausted, it will take many thousands of years for it to again accumulate in sufficient quantities for use, even if the conditions necessary to its production were now present, which he thinks very improbable.

Of course there will be plenty to scoff at this, and there are many whose interest it is to have people believe that the supply of natural gas is really inexhaustible; but to him who looks over the matter carefully and unbiased by special interests there seem to be many good reasons for believing that Prof. Orton's view of the matter is about right. And there can be little doubt that the exhaustion of the natural gas fields will be looked upon with a considerable degree of complacency by the vast majority of the people of the country. Natural gas has by no means proven so valuable to the people at large as was anticipated by many enthusiasts, the chief reason for this disappointment being probably its restriction to such a comparatively small territory. Of course it has been a great benefit to many manufacturers who happened to be so situated as to enable them to take advantage of the opportunities offered, and it has furnished a comparatively cheap, and very convenient and cleanly fuel to many families. But the most substantial part of its benefits have been reaped by the real estate speculators, the money which they have pocketed having of course been extracted from those who carry on productive enterprises, for the privilege of using the gas.

And even under the most favorable circumstances, where such an advantage as natural gas can be utilized by only a portion of those necessarily engaged in a given industry, nothing like a general benefit can result; for prices will of course be regulated by the cost of production under the least favorable circumstances so long as such production is necessary to supply the regular demand for the article produced.

Under other circumstances natural gas might have proven the benefit to mankind which it was claimed it would be, but the art of monopolization and of confining the benefits of a new discovery to the few has been so fully developed as to set at naught most calculations regarding such matters.

Findlay, Ohio, in which the real estate boom, following the discovery of natural gas, was, perhaps, the wildest seen in the gas territory, and many of the citizens of which seemed to actually believe that no manufacturing of any account would after a year or two be done anywhere else, is now the headquarters apparently of the recently formed window glass trust, which is a very good illustration of one of the ways in which the people are prevented from reaping too great benefits from the gifts of nature.

In many other towns, especially in Pennsylvania, citizens are engaged in contests of various kinds with the companies which have been supplying gas, and there is much evidence that even in some of the towns which were supposed to be especially favored by fortune in this matter, there are people who would be just as well satisfied if natural gas had never been heard of, and who will be by no means disposed to weep over the predictions of Prof. Orton.

What is in a Name?

Sometimes, perhaps, a sub-title may be applied to a product of the shop, which, under the circumstances, possesses a significance that overcomes its objectionable features. But this is very rarely the case. As a general thing, such an epithet carries with it distrust, as if the attempt was to bolster up with a name, something that was lacking in other requisites. There may be a good deal in the name of an individual, but a sub-explanatory title to a good, honest product of the shop is, in ninety-nine cases in a hundred, not only of doubtful propriety, but it loads down what may really be a good thing with a positive hindrance to its adoption. Many a promising device has brought nothing but grief to its possessor, through a failure of its merits to make headway against the incubus of a name.

It is rather easy to see how such titles sound by going—only a little—to extremes. Let some firm start in the building of locomotives, doing good, honest work, and turning out a product of superior quality in every respect. Suppose that, emulating the example of the manufacturers of a good many other machines, this firm style their product "The Get There" locomotive, or something else equally silly, for which it need not go far for an example. Does any one suppose that the firm would not start with a load that would prove too much for it to carry?

The fact is, that the efforts to fish in the air for a prefix to the plain title of a machine—a prefix that does not tell anything of the machine—are generally held to be evidence of what in this country is called "blowing." They partake too much of patent medicine literature. A lathe is a lathe and a planer is a planer, and while it is perfectly legitimate to set forth plainly their good qualities, any attempt to do so by the means of some high-sounding prefix would at once be condemned. Yet these tools are only different in kind from a good many machines that stagger along under some meaningless prefix. If we wanted to buy a screw-driver we should buy one by that name, after exercising a little judgment as to its probable merits. If it was labeled "The Start 'em every Time" screw-driver, we should distrust our ability to judge of the merits of the name, and go where the article known by its plain title could be had.

Eternal protest of one's honesty always raises suspicion, and a windy name for some common article is very likely—or certain—to operate in the same way.

John Holden, who is fireman at the city workhouse, addressed the council, asking for a free license as an engineer, claiming that his salary, $30 per month would not enable him to live and pay $5 for a license. After some discussion, the mayor was instructed to issue a license, and charge it to the charity fund.

We take the foregoing from the *Daily News* of St. Joseph Mo. It contains a good deal worth thinking about. Here is a man, with a good, honest name, intelligent and skilled enough to pass an examination and secure a license as fireman, where a good many lives depend upon the manner in which he performs his duty. A great city pays him thirty dollars a month for his services, and then fines him five dollars for the privilege of working. But the mayor is kind-hearted. He graciously consents to make a pauper of John Holden to the extent of five dollars a year.

In the way of a city, St. Joseph, paying a competent fireman thirty dollars a month, and pauperizing him to the extent of his fine of five dollars, draws it finer than anything we have read. We should advise Holden to shake the dust of St. Joseph from his feet, and get a job at something else—coal mining, for example. But come to think of it, just how he is to raise money enough to get to a coal mine on thirty dollars a month is more than we can see. The probabilities are, he will have to remain mortgaged as a pauper to the city. Those officials who fixed the pay of a licensed fireman at thirty dollars a month ought to be put on the same pay for a year or two.

The wrangle in regard to the location of the World's Fair of 1892 is unseemly. In common with a good many others, it seems to us that New York City is the proper place for the fair. But there are a half dozen other cities in the country that would do justice to the occasion, and we doubt if the daily press of the metropolis, or some of the hot-headed citizens, strengthen the position of New York by ridiculing the fitness of other cities for the honor. While we think New York, on many accounts, the fittest place for the great fair, we have no doubt of its success if held at Chicago, or St. Louis, or Washington. The question should be met in a dignified manner, and settled on it merits.

Literary Notes.

The 24th half-yearly volume of "Ealy's Blue Book" appeared on January 1st, containing what is, so far as we know, the best published list of manufacturers and dealers connected with the hardware, stove, iron, machinery and kindred trades, for the United States and Canada. The book forms the basis of a system for ascertaining commercial credits, and is published by The John W. Ealy Co., 280 Broadway, New York.

QUESTIONS AND ANSWERS

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according o common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. f so requested, neither nam., correct initials nor location will be published.

(26) C. E. B., Rockville, Ct., asks: Should ball bearings be oiled? If so, why? *A.*—They should be oiled, to prevent cutting.

(27) T. H., N. Y., writes: Please give me a method to find the angles and diameters at the large and small ends of teeth for cutting bevel gears, having the pitch, diameter and number of teeth. *A*—You will find articles on this subject in our issues of October 31, 1885, and May 1, 1886.

(28) H. J., Seattle, W. T., writes: Please state the loss in transmitting electricity through copper wire fifty miles. Current sufficiently high for arc lights, and size of wire necessary to transport 2,000 horse-power. *A.*—We do not think any one can tell what the loss would be until it is tried.

(29) B. B. S., Dylesworth, Ind., writes: I have heard of an engine for agricultural purposes that will not run down the hill with throttle open any faster than it will run up hill. Please give the reason. *A.*—In the first place, it seems to us that you have not been correctly informed; for the force of gravity must certainly make the engine run down the hill faster than it will run up, although the difference may be very small, and will depend on the grade. It is also probable that the slide valve has a great amount of lap, giving excessive back pressure, which, to some extent, will limit the speed of engine.

(30) C. W. B., ———, asks: Can you give us a formula for welding cast steel? We have a number of small pieces of tools which we would like to weld up if it can be done economically. *A.*—We suppose you mean ends of lathe and planer tools which have become too short to be dressed; and if so, then we know of no way of doing it which is practical. A good blacksmith can weld cast-steel, but whether it will pay or be practical to do it in a given case or not, must be determined by circumstances in each case. It very seldom pays, and never in such cases as we suppose you have reference to.

(31) J. L., Montreal, Canada, writes: I am a machinist, unmarried, and twenty-five years of age. I have a fair theoretical knowledge, and am ambitious to rise. Would it be to my advantage to go for a college course? Are there any such technical colleges in Canada or the United States, and what are the conditions of admission and probable expenses? *A.*—We cannot say certainly whether it would be for your advantage to take a course in a technical school or not, but it probably would. We presume there are such schools in Canada, though we know of none. Some of the leading ones in this country are: The Worcester Polytechnic Institute, Worcester, Mass.; Cornell

University, Ithaca, N. Y.; Stevens Institute of Technology, Hoboken, N. J.; University of Illinois, Champaign, Ill.; Lehigh University, Bethlehem, Pa.; Massachusetts Institute of Technology, Boston, Mass.; Ohio University, Columbus, Ohio. By addressing any of these institutions by the titles given, you will get full information regarding conditions of admission, and cost, etc.

(32) W. McV., Dresden Ont., writes: Please give the colors of steel tools when drawn to a proper temper; also number of degrees for each color. *A.*—

Temperature.	Color.	Use.
482° Fahr.	Pale yellow	Surgical instruments.
446° "	Straw	Penknives, razors, wood tools.
491° "	Brown yellow	Chisels and scissors.
509° "	Purplish	Axles, heavy knives.
527° "	Purple	Table knives, springs.
534° "	Pale blue	Watch springs, swords.
563° "	Dark blue	Fine saws, drills.
600° "	Very dark blue	Hand saws.
662° "	Very dark blue, or green	Too soft for any ordinary tools.

The temperature, which is indicated by the color, is constant, or nearly so, for any one steel, and is slightly different for different steels. The above has been taken from "Materials of Engineering," Part II, by Prof. R. H. Thurston.

(33) E J., Rockwood, Tenn., writes: I have to lay out a piece of work whose form is like that of a frustum of a cone, as shown in sketch, Fig. 1. How can I find the length $v\,b$ by calculation? *A.*—In the first place find the length of $b\,d$ (Fig. 1) as follows: Add the square of $f\,b$ to the square $f\,d$, extract the square root from the sum; the result will be the length of $b\,d$. Thus: The square of $f\,b$ is equal to $4 \times 4 = 16$; the square of $f\,d$ is equal to $14 \times 14 = 196$; the sum is $16 + 196 = 212$; and the square root of 212 is equal to 14.56 inches, which is the length $b\,d$. Now $b\,f$ is to $g\,b$ (one-half of the diameter of large base) as $d\,b$ is to $b\,v$; hence we have $4 : 39 :: 14.56 : v\,b$; consequently $v\,b = \frac{39 \times 14.56}{4} = 141.96$ inches. 2. How can I find the development of this surface? It is to be made of ten sections, with one-half inch space allowed between the sections. *A.*—The surface lying between the two arcs $a_2\,b_2$ and $c_2\,d_2$, in Fig. 2, represents one-half of the whole development, and the shaded surface represents the development of one section. To find this, proceed as follows: From any point v_2 as a center, and with a radius equal to 141.96 inches, describe the arc $a_2\,b_2$; and, since this figure represents only one-half of the development, make the length of the arc equal to $\frac{78 \times 3.1416}{2} = 122.52$ inches. Draw straight lines from the center v_2 to the extremities a_2 and b_2 of the arc; from the center v_2, and with a radius $v\,d$, describe the arc $c_2\,d_2$, terminating in the radial line $v_2\,b_2$ and $a_2\,a_2$; this completes the development of one-half of the convex surface of the frustum of the cone. Divide the arc into five equal parts, and through the point of division h draw a straight line to v_2. Parallel to the line $v_2\,h$, and one-quarter of an inch from it, draw the line $l\,k$; also parallel to $v_2\,a_2$, and one-quarter of an inch from it, draw the line $m\,n$, thus completing the outline of the shaded surface, which, as we have stated before, is the development of one section. For the development of conical surfaces see AMERICAN MACHINIST, December 19, 1889. Your calculations are not correct.

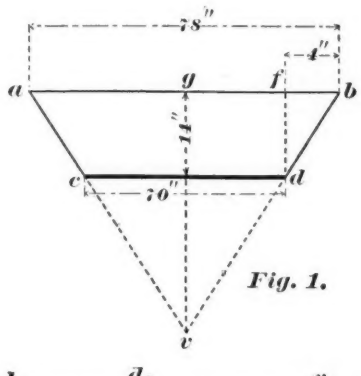

Fig. 1.

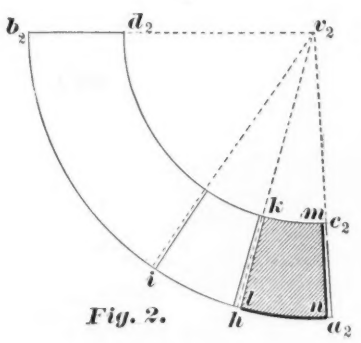

Fig. 2.

(34) W. H. C., Chicago, Ill., writes: Please answer the following questions, to decide an argument: 1. What causes the water to flow through a siphon? Also state the greatest height to which the water can be lifted by means of the siphon. *A.*—The siphon will work only when the water level at one end is higher than at the other, and, although the legs are sometimes of equal length, we may, on account of the difference of the water level, always consider the siphon to be a bent tube with unequal legs. In order to use the siphon it is first filled with the liquid, and when the short end has been immersed, a flow of the liquid takes place, transferring it from the higher to the lower water level. To explain the cause of this flow, let us suppose the siphon to be filled, and the short leg immersed in the liquid. The atmospheric pressure on the higher water level tends to raise the liquid in the tube, and the total pressure is equal to that of the atmoshere minus the column of liquid in the short leg. In like manner the pressure at the end of the long leg is equal to that of the atmosphere minus the column of liquid in the long leg. But the latter column, being higher than the former, will weigh more, and therefore reduces the resistance, or the pressure to be overcome at the long end of the tube, and consequently a flow takes place proportional to the difference between the two forces acting at the ends of the siphon. The flow will therefore be more rapid in proportion to the difference of the water level. It follows from the theory of the siphon that it will not work in vacuo; neither will it work when the height of the column of liquid in the short leg is greater than that of a column of the same liquid which counterbalances the atmospheric pressure, and, if friction is taken into account, the column in the short leg will have to be still less. 2. What causes the oil to flow up the wick of a lamp? 3. What causes the tallow to flow up the wick of the candle? *A.*—The flow is caused by capillary attraction; that is, the mutual attraction of the liquid molecules for each other, and to the attraction between these molecules and solid bodies.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.

Gear wheels and g-cutting. Grant, see adv., p 16.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells, & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N.Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

S. W. Card & Co., Mansfield, Mass., carry a full line of Stay Bolt and Patch Bolt Taps.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

Valve Motion Model, adjustable in all its parts, 100 now in use. See ad. in "Misc. Wants" column.

Locomotive Driving-Box Planer Tool. Pedrick & Ayer, Philadelphia, Pa.

Special Tools for Railway Repair Shops. Pedrick & Ayer, Philadelphia, Pa.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Dec. 12, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Patent Attorney. R. G. DuBois, 715 11th st., Washington, D. C., procures first-class patents on inventions. Valuable Hand-book on patents free.

25" 28" 32" 36" Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

25" 32" 37" 42" "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Standard Reducing Valve, Standard Pump Pressure Regulators, Improved Collignon Cylinder Oil Pumps, Jenkins Globe and Angle Valves. Send for circulars. Standard Regulator Co., Buffalo, N. Y.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations. 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt st., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines. T. C. Dill Machine Co., Philadelphia, Pa.

Just concluded. "Practical Drawing." By J. G. A. Meyer. Copies of the American Machinist containing the above series of 93 articles sent by mail to any address in the U. S., Canada or Mexico, for $4.65, or single copies 5 cents each. American Machinist Publishing Co. 96 Fulton st., New York.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't De Lamater Iron Works, will hereafter manufacture the De Lamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the De Lamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st., New York.

Just concluded. "Modern Locomotive Construction." By J. G. A Meyer. The above series of 106 articles, which have attracted so much attention everywhere, is now concluded in newspaper form. Copies of the American Machinist containing the entire set sent by mail to any address in the U. S., Canada or Mexico for $5.30, or single copies 5 cents each. American Machinist Publishing Co., 96 Fulton st., New York.

C. H. De Lamater & Co. have closed their extensive manufactory at the foot of West 13th street, New York, and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale a very desirable lot of machinery, such as lathes from 15" to 88" swing, planing machines 48"x45"x10', 53"x50"x12', 17' x14"x24', 72"x69"x24', and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel, also steam hammers and two 8"x16" and one 10"x20" Rider cut-off engines.

MANUFACTURES

The Bethlehem Iron Company has leased the Lucy Furnace, at Glendon, Pa.

The Peoria (Ill.) Rolling Mills Company has been incorporated, with capital stock $200,000.

Daniel Congdon & Son will rebuild their planing mill, recently burned, at New Berne, N. C.

Scottdale (Pa.) business men are moving in the matter of building a machine shop and foundry.

The Dupont Paper Mill Co., Louisville, Ky., will put in new machinery and an electric light plant.

The cordage factory of J. T. Donnell & Co., at Bath, Me., recently burned, will be rebuilt at once.

The National Foundry and Pipe Works, Scottdale, Pa., are making extensive improvements to their plant.

The Fort Worth (Texas) and Arlington Heights Street Railway Company, capital stock $300,000, has been chartered.

It is said that an electric railway will be built between Athol and Orange, Mass., a distance of five and a half miles.

The Michigan Saw Company, East Saginaw, Mich., will build new works, and fit up with the most modern machinery.

The box factory at Lyndonville, Vt., formerly belonging to Cunningham & Chase, will be started up by a stock company.

The Fox Solid Pressed Steel Co. has filed a certificate in Illinois of the increase of the capital stock from $750,000 to $1,000,000.

The Sullivan Mfg. Co. has been organized at Anderson, S. C., to manufacture agricultural implements, and doors, sash and blinds.

The hosiery mill of S. Hodgson, at Meredith Village, N. H., recently burned, will probably be rebuilt, citizens having subscribed to the stock to that end.

We are informed by the manufacturer, Randolph Brandt, New York, that he has recently filled a large order for "Selden Patent Packing" from Germany.

The Mayo Press Manufacturing Company, with a capital of $100,000, has been incorporated at Paris, Texas. It has not yet been determined where the factory will be located.

In our issue of January 9 we noticed the fact that A. B. Landis, with his brother, had started a shop for tool building at Waynesboro, Pa. The name of the firm is Landis Brothers.

The Aurora (Ill.) Watch Company's Works have passed into the hands of C. D. Rood, who proposes to greatly enlarge the plant, and employ 1,000 men and women, instead of 250, as heretofore.

There is water-works agitation at Ballinger, Texas; Bridgeport, Ala.; Orange City, Fla.; Reedsville, N. C.; Claude, Texas; Greenville, Ohio; Keyport, N. J.; Hamburg, N. Y.; South St. Paul, Minn.; Carapolis, Pa.; Marlin, Texas.; Albert Lea, Minn.

The Seamless Structural Company has been incorporated by B. S. Bigelow and others, at Milwaukee, Wis., with a capital of $40,000, divided into 400 shares. The company will manufacture steam boilers, cylinders, tubes, etc., presumably by welding.

The Rogers Foundry Company and the Pump and Skein Works, at Belleville, Ill., are each increasing their facilities, and both corporations have called meetings of their stockholders to vote upon an increase of the capital stock from $25,000 to $75,000.

The Sioux City Engine Works are about to move their plant to Leeds, the manufacturing suburb of Sioux City. Their principal business is constructing Corliss and medium speed automatic engines and boilers. Their capacity for Corliss engines is 150 a year.

The Maslin pulsator pump, illustrated not long since in the AMERICAN MACHINIST, is, we are told, being used for pumping phosphate deposits and minerals in Florida. The manufacturers, John Maslin & Son, Jersey City, N. J., expect to do considerable business in supplying such outfits.

H. F. Frasse, A. H. Briggs and S. J. Frasse have formed a partnership under the firm name of Frasse & Co., New York. The new company takes the place of the partnership existing between S. J. Frasse, A. H. Briggs and T. S. Wells, under the same firm name, the last-named partnership having expired by limitation.

The following, from the parties named, explains itself: The Detrick & Harvey Machine Company, of Baltimore City, a corporation, succeeds the firm of Detrick & Harvey, and, with increased facilities, will continue the manufacture of the open side iron planers, machine tools, special and general machinery. J. S. Detrick, president; Alex. Harvey, secretary and treasurer.

The name of the Bucyrus Foundry and Manufacturing Company, of Cleveland, O., has been changed to the "Bucyrus Steam Shovel and Dredge Company," which will better describe its business. The organization and management will remain the same, the change being one of name only, except that the capital stock has been increased to $150,000 to accommodate the constantly increasing business, and to allow the necessary extension of the plant.

The Loup City (Neb.) Canal, Water-power and Improvement Company has been organized, with a capital stock of $150,000. This enterprise contemplates the building of a canal three miles long, tapping the Middle Loup river at a point near Arcadia, and extending down the valley to a point near Loup City, where it cuts through a divide and enters a deep canyon, where a lake will be furnished two and one-half miles long and one-half mile wide, with a direct fall of ten feet, making one of the best water-powers in the West.

Jones & Mack, mechanical engineers, 5 West 14th street, Cincinnati, Ohio, write us: The outlook for the coming year is very good. We say this because our business has been constantly increasing during the past year, and does not show any signs of slacking up now. We have fitted up a shop for the manufacture of the I X L drawing stand, recently brought out by us. This stand has been well received, and in every instance has given perfect satisfaction. Among other machine tools we have designed is a new automatic bevel gear cutter, which will soon be brought out by a prominent machine tool builder. We have also been employed a large part of our time on paper machinery, one of our achievements in that line being an equalizing winder for three or more rolls.

The Holly Manufacturing Company, builders of the Holly system of water-works, and the Gaskill pumping engines, hydrants and valves, Lockport, N. Y., write us: The expectations of last year for 1889 were fully realized, the sales having been much larger than for any other year. Contracts were procured during the year for thirty-seven pumping engines of from 500,000 to 20,000,000 gallons each daily capacity, and for 2,300 fire hydrants and double gate valves. The number of men employed on full time was 505, and the machine and pattern shops have been running with 100 men three hours overtime since November 1st, on heavy work. The work in the shops under contract January 1st, 1890, was sufficient to run the whole plant for five months, and the prospects for an amount which will bring the aggregate of sales up to, if not in excess of last year's business, are very encouraging. The prices received were fair, but, in view of the recent advance in metals, they will be, if it continues, proportionately increased. The company has erected a building, 54x144 feet, which will be specially devoted to the manufacture of fire hydrants and straightway valves of from 4 to 48 inches diameter. There has been no material change in prices of labor. May we add that this is the 31st year of the company's active operations; that it has never postponed a pay roll; has always paid its employes cash in full each week; has never had a strike; never went to protest, and has had but one and the same president since its organization

Machinists' Supplies and Iron.

NEW YORK, Jan. 18, 1890.

Iron—American Pig.—A generally quiet feeling pervades the market, and there is much less new business transacted than would naturally be expected, and which would take place were it not for the deliveries which are being made on former contracts. There have been some offerings of Southern brands, but no sales of any great amounts. We quote No. 1 X Foundry, $20; No. 2, $19. Grey Forge, $18.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Good machinists, and one or two pattern makers. The Pond Mach. Tool Co., Plainfield, N. J.

Competent general draftsman wants steady employm't. Familiar with shop work. Box 73, AM. MACH.

Wanted—Tool maker on W. & G. work. Address, with refs. and wages expected, Box 128, Yonkers, N. Y.

Competent mechanical draftsman desires engagement. F. L. M., 304 Noble ave., Bridgeport, Conn.

Wanted—Exp'd mechanical draftsmen. State ability and salary. Balto. Sug. Ref. Co. South Baltimore, A. A. Co., Md.

Foreman and contractor wanted, who can handle men and do good work promptly. Address Steam Engine, care AMERICAN MACHINIST.

A mechanical draftsman is open for engagement. Thoroughly competent in machine and engine designing. Shop. exp. Box 74, AMERICAN MACHINIST.

Machinists Wanted—First-class vise and machine hands of good habits, can find steady employment and liberal wages. Address Morgan Engineering Company, Alliance, Ohio.

A thorough practical machinist, having held position as foreman, is open for engagement. Has had experience in engine work and heavy machinery. Engine, care Letter Carrier No. 75, Cleveland, O.

Wanted—A reliable, competent man, exp'd in office work and correspondence, familiar with engines, boilers and appliances. Apply by letter, giving refs. and salary required, to W., AM. MACHINIST.

Wanted—Position as foreman or draftsman by a technical graduate, 8 years in shop, and drafting on engines, tools, etc. Vicinity of Chicago preferred. Address Box 76, AMERICAN MACHINIST.

Man Wanted—To take charge of our brass foundry as foreman. Must be experienced in mixing metals and moulding in all details. Address, with references, The National Cash Register Co., Dayton, Ohio.

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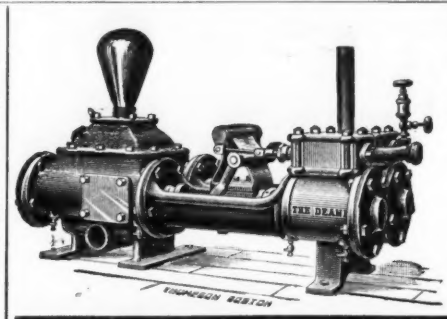

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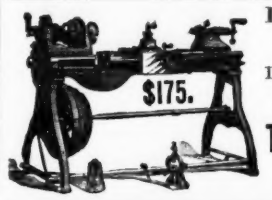

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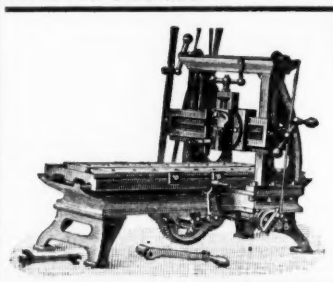

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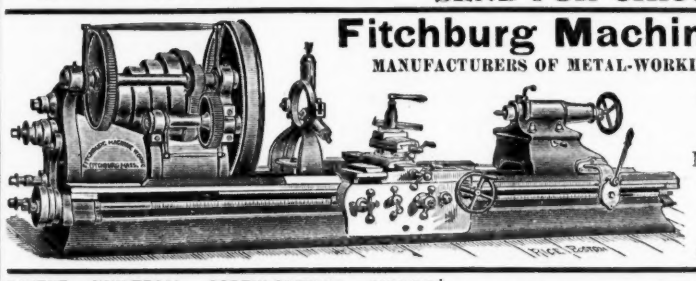

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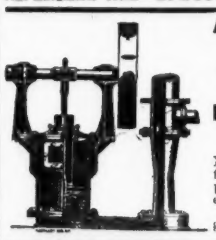

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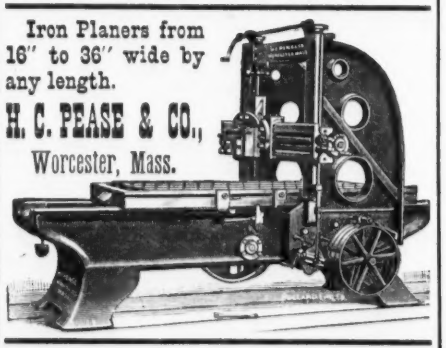

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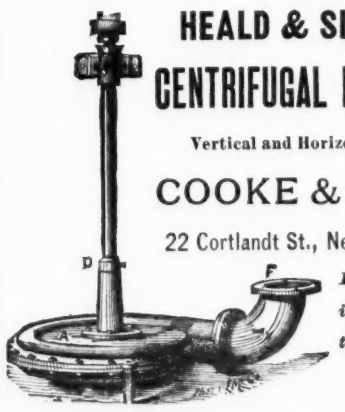

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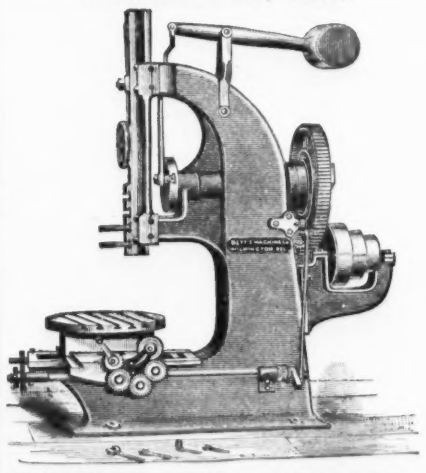

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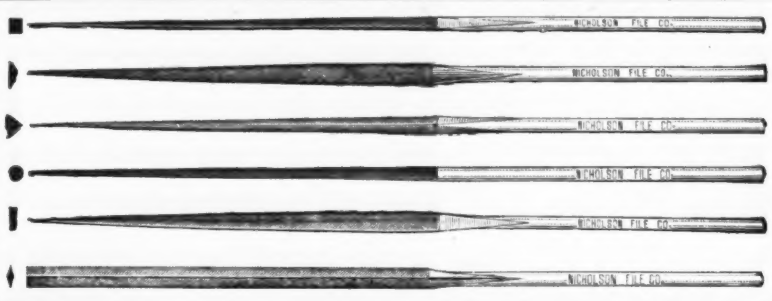

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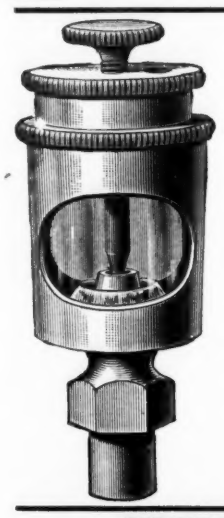

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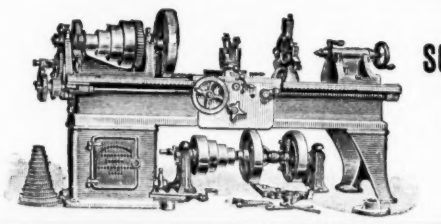

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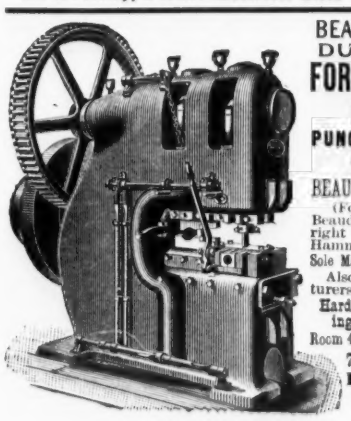

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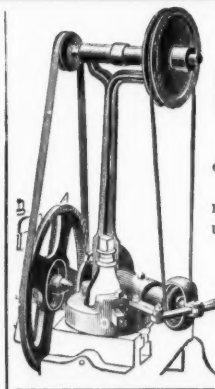

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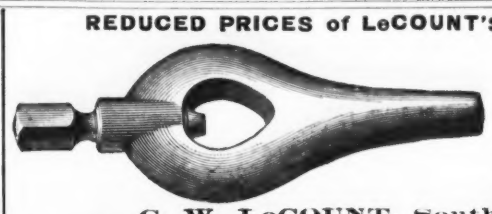

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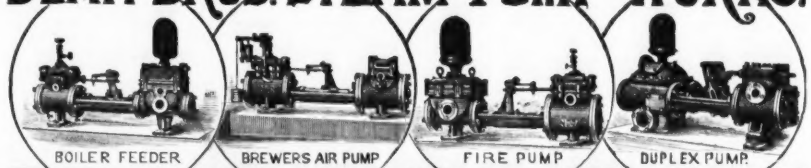

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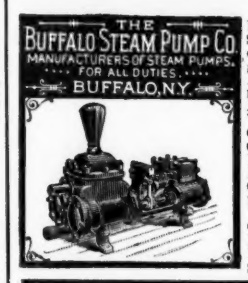

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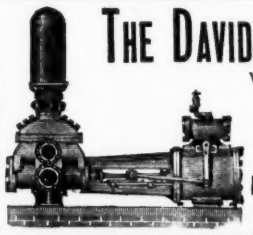

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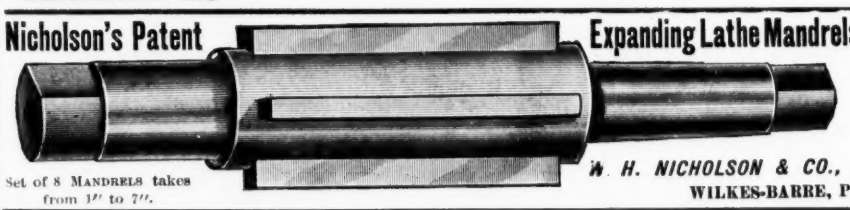

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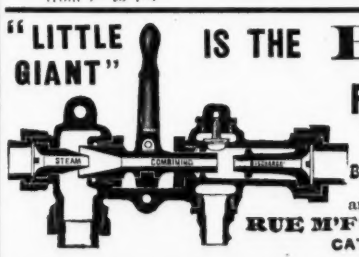

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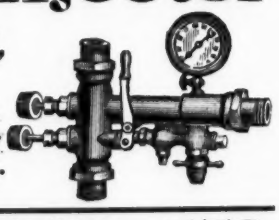

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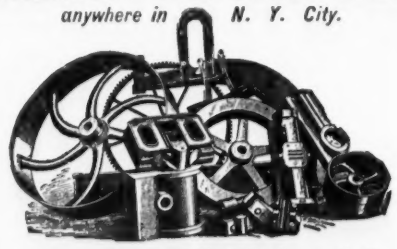

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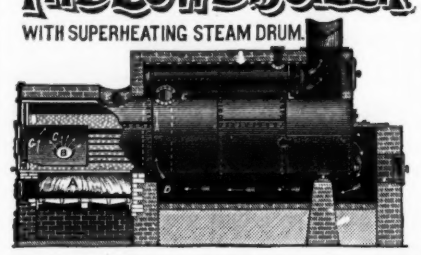

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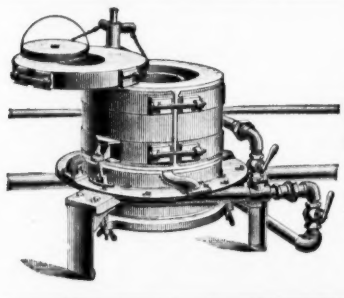

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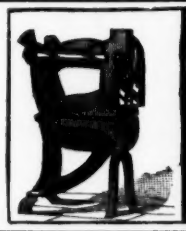

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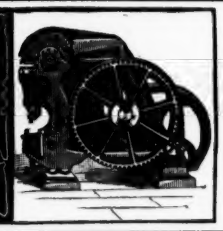

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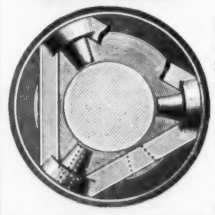

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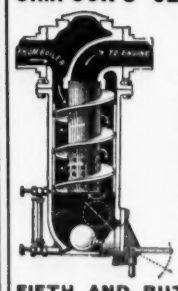

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16 in.	18 in.
18 1-2 in.	21 1-2 in.
21 1-4 in.	26 in.
24 in.	30 in.
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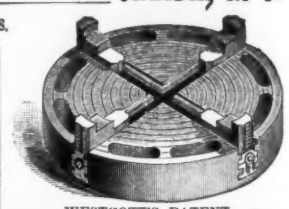

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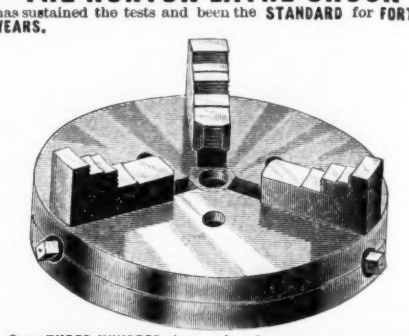

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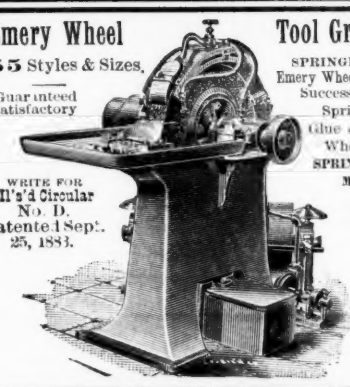

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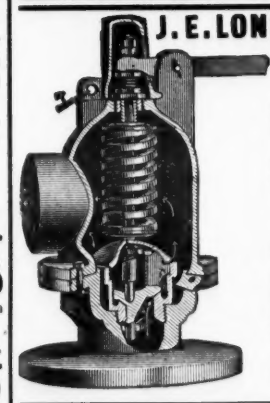

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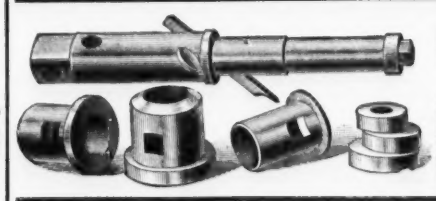

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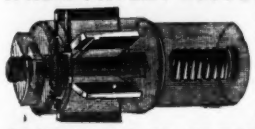

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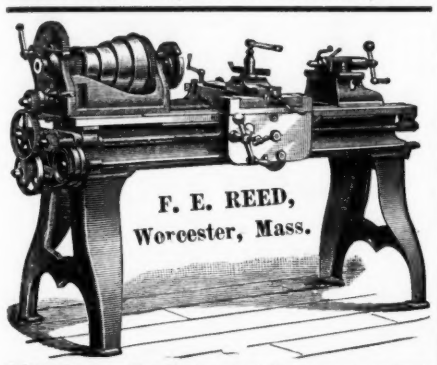

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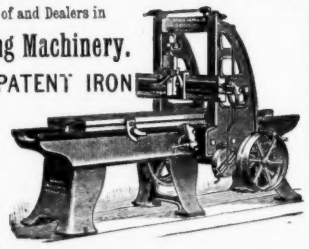

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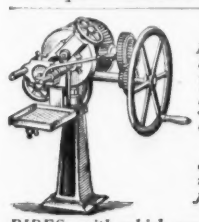

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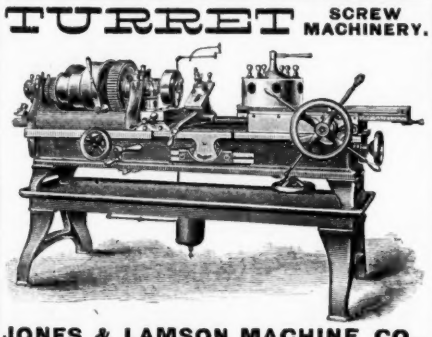

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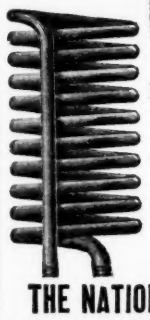

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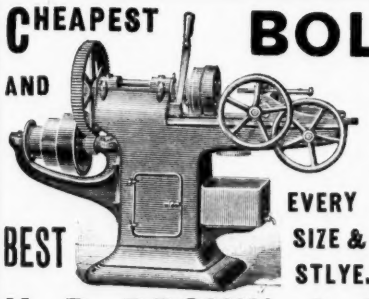

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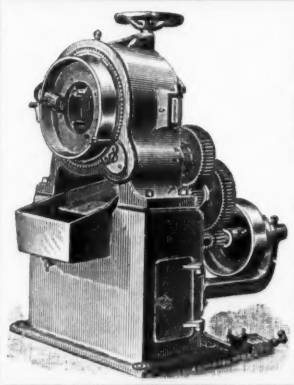

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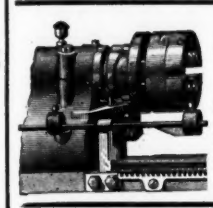

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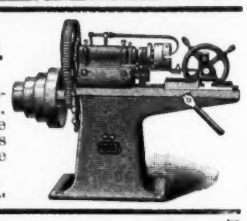

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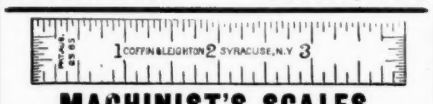

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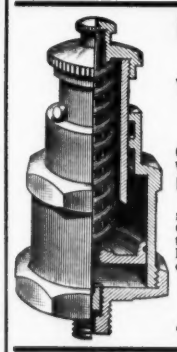

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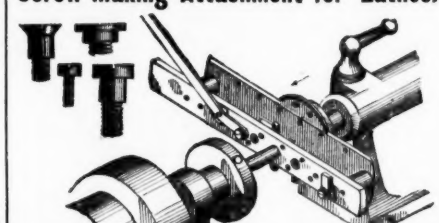

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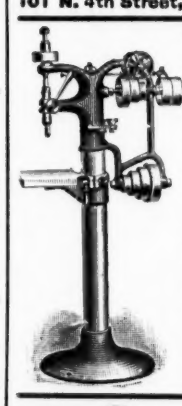

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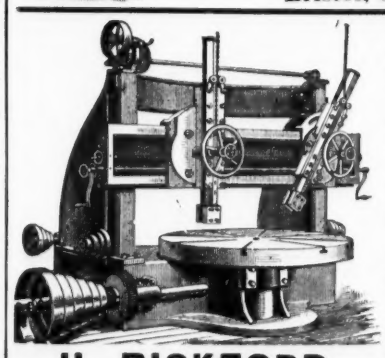

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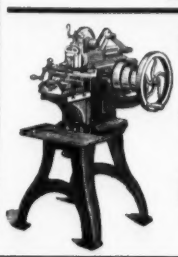

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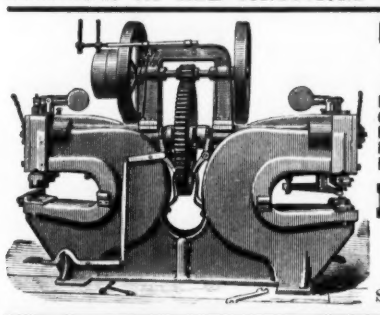

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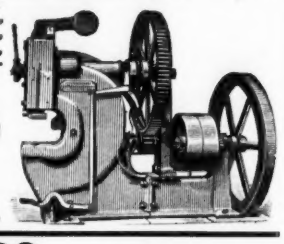

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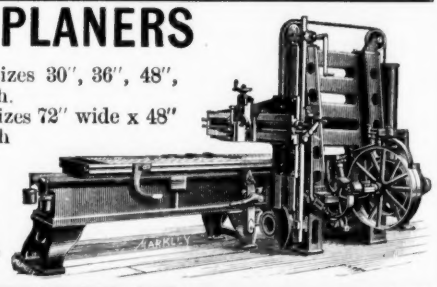

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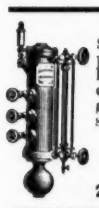

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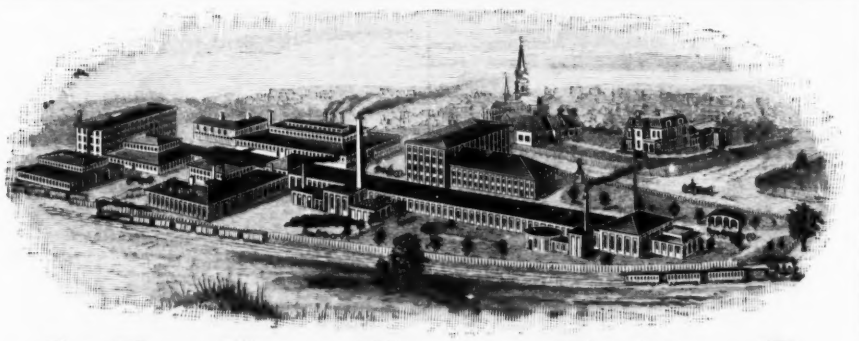

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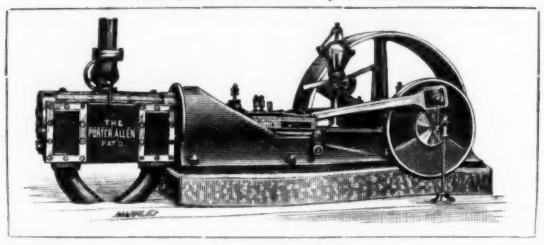

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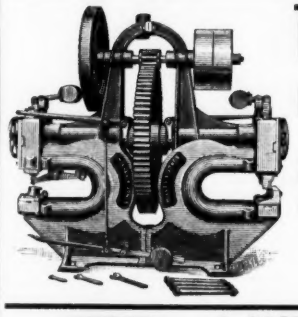

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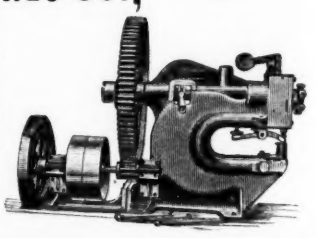

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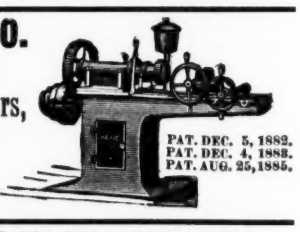

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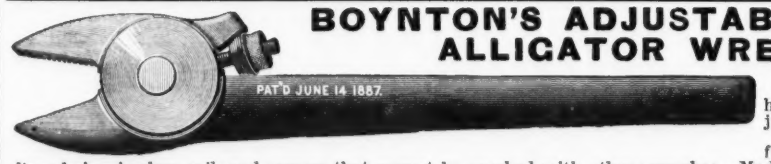

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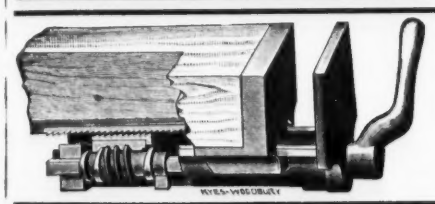

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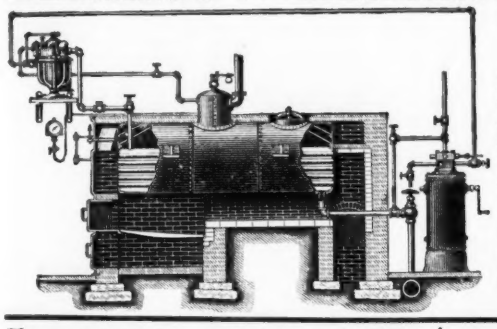

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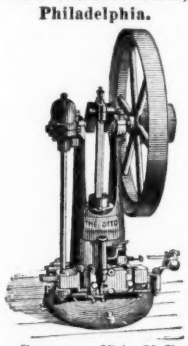

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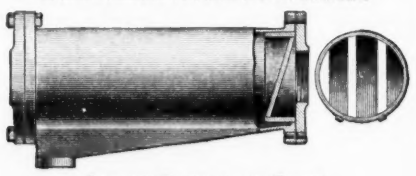

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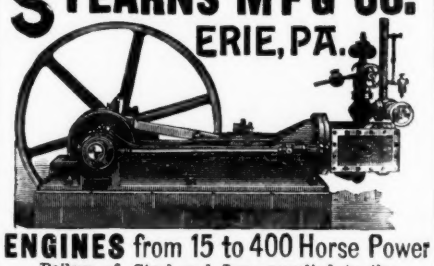

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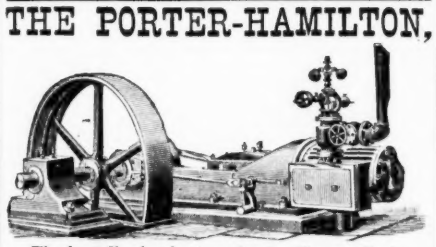

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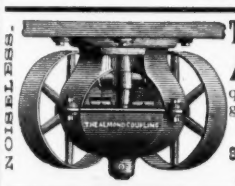

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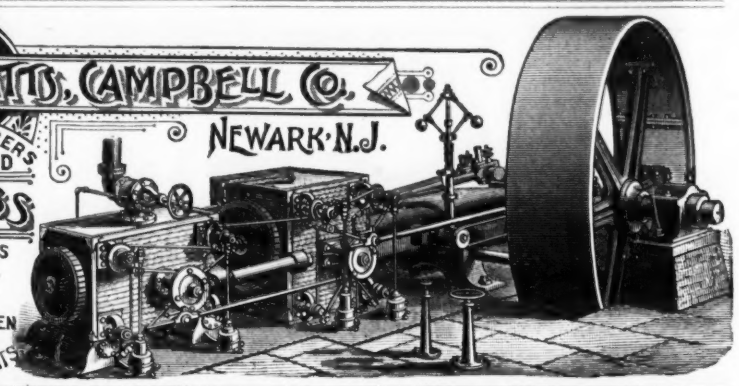

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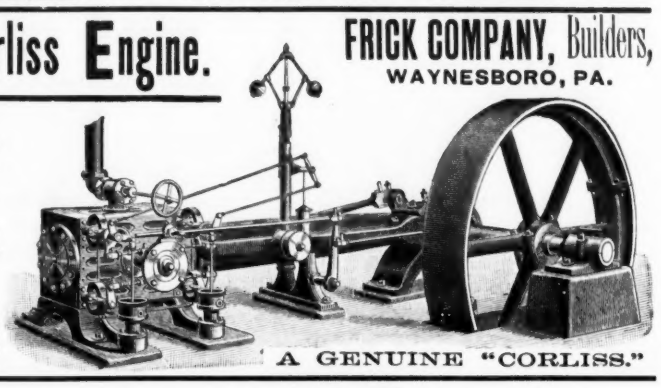

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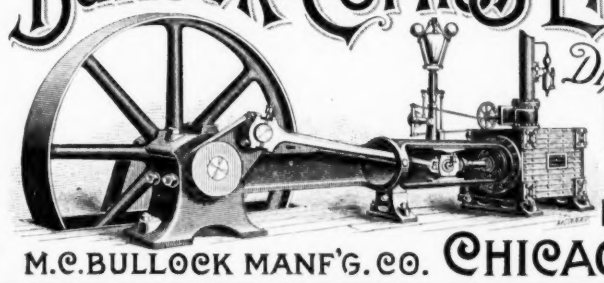

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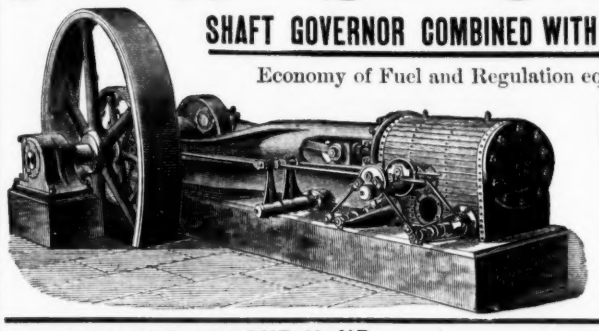

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1 14 in. x 6 ft.	Engine Lathe, plain,	Fitchburg	new.
1 14 in. x 6 ft.	" "	Blaisdell	good.
1 15 in. x 5 ft.	" "		good.
1 15 in. x 6 ft.	" "	Porter,	new.
1 15 in. x 8 ft.	" "	"	new.
1 18 in. x 6 ft.	" "	Wright,	new.
1 18 in. x 8 ft.	" "	"	new.
1 16 in. x 6 ft.	" "	Fitchburg,	new.
1 16 in. x 6 1-2 ft.	" " plain,	Hendey,	new.
1 16 in. x 8 ft.	" " "	"	new.
1 18 in. x 6 1-2 ft.	" " "	"	new.
1 18 in. x 6 1-2 ft.	" " taper,	"	new.
1 18 in. x 8-10-12 ft.	Engine Lathe, taper,	"	new.
1 18 in. x 8-12 12 ft.	" " plain,	"	new.
1 18 in. x 8 ft.	Engine Lathe, plain,	Fitchburg,	new.
1 20 in. x 8 ft.	" "	Wright,	new.
1 20 in. x 10 ft.	" "	"	new.
1 24 in. X 12 ft.	" "	Fitchburg,	new.
1 24 in. X 12 ft.	" "	Wright,	new.
1 54 in. X 20 ft.	" "	Fitchburg,	new.
1 14 in.	Traveling Head Shaper,	"	new.
1 26 in.	Rack Shaper,	Lodge, Davis & Co.,	new.
24 in.	Shaper,	Hendey,	At order.
1 25 in.	Bk. and Self Feed Drill Press,	Prentice,	new.
1 32 in.	" " "	"	new.
1 24 in. x 24 in. x 6 ft.	Planer,	Fitchburg,	new.
32 in. x 32 in. 8ft.	"		new.
1 30 in. X 24 in. X 5 ft.	Planer	L. W. Pond,	good.
1 60 in. x 55 in. 24 ft.	"		good.
1 26 in.	Pulley Machine, 1 head,	Stevens,	good.
1 36 in.	" "	"	good.
1 12 in.	12 in. x 5 ft. Slab Miller,	Eynon,	new.
No. 1 B. & S.	Screw Machine,		good.
No. 3	"		good.
No. 2 J. & L.	"		good.
2 in.	Comb. Bolt and Pipe Cutter,		new.
1 No. 1	Universal Milling Machine,	Eynon,	new.
1	Allen Bridge Riveter and Comp.,		good.

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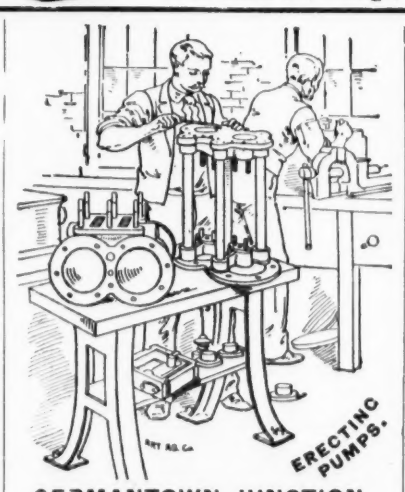
PATENTS THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide.



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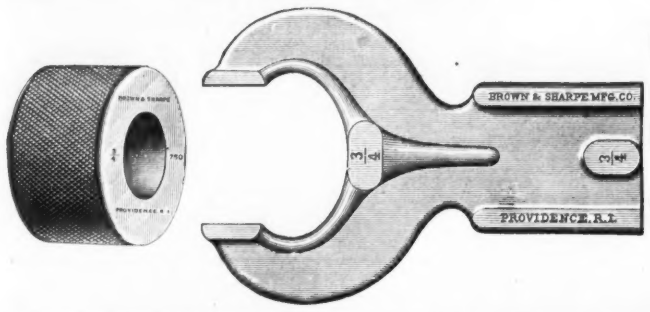

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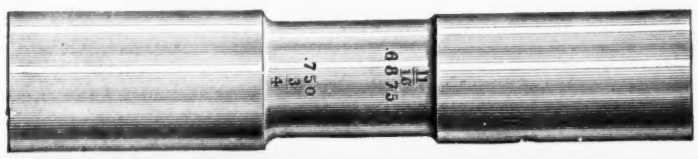
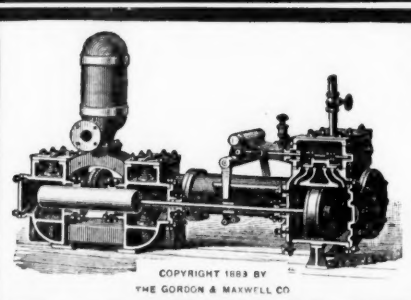
CYLINDRICAL GAUGES

Standard Caliper Gauges.



Standard Cylindrical Gauges.



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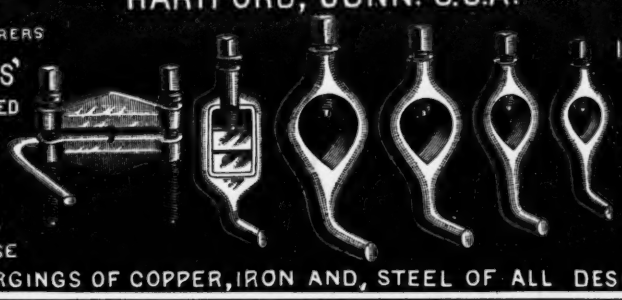

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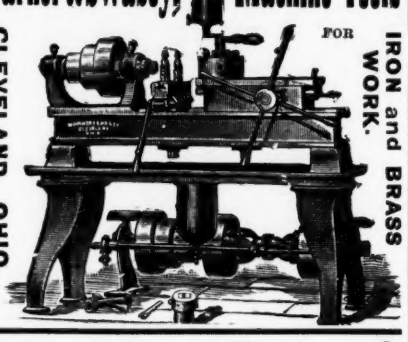

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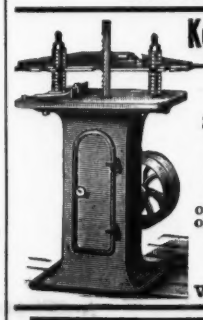

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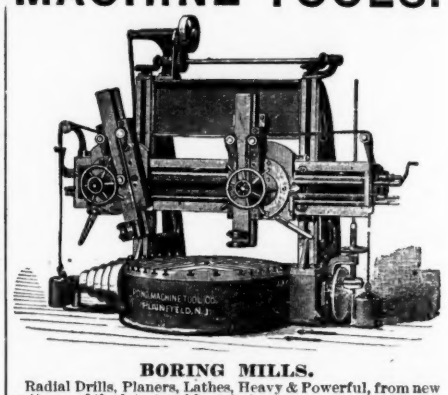

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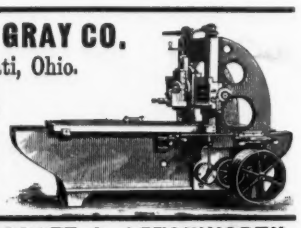

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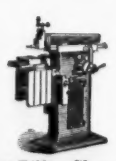
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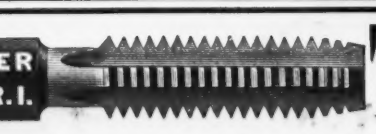

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